National Library
of Canada

Canadian Theses Service

Ottawa, Canada
K1A 0N4

Bibliothèque nationale
du Canada

Services des thèses canadiennes

CANADIAN THESES

NOTICE

The quality of this microfiche is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Previously copyrighted materials (journal articles, published tests, etc.) are not filmed.

Reproduction in full or in part of this film is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30. Please read the authorization forms which accompany this thesis.

THIS DISSERTATION
HAS BEEN MICROFILMED
EXACTLY AS RECEIVED

THÈSES CANADIENNES

AVIS

La qualité de cette microfiche dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

Les documents qui font déjà l'objet d'un droit d'auteur (articles de revue, examens publiés, etc.) ne sont pas microfilmés.

La reproduction, même partielle, de ce microfilm est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30. Veuillez prendre connaissance des formules d'autorisation qui accompagnent cette thèse.

LA THÈSE A ÉTÉ
MICROFILMÉE TELLE QUE
NOUS L'AVONS REÇUE

NL 339 (r. 86/01)

Canada

170

National Library of Canada
Bibliothèque nationale du Canada

Ottawa, Canada
K1A 0N4

TC –	
ISE	0-315-23364-8

CANADIAN THESES ON MICROFICHE SERVICE – SERVICE DES THÈSES CANADIENNES SUR MICROFICHE

PERMISION TO MICROFILM – AUTORISATION DE MICROFILMER

- Please print or type – Écrire en lettres moulées ou dactylographier

AUTHOR – AUTEUR

Full Name of Author – Nom complet de l'auteur

JANE HUXLEY HOPKINSON

Date of Birth – Date de naissance

APRIL 27, 1941

Canadian Citizen – Citoyen canadien

☑ Yes / Oui ☐ No / Non

Country of Birth – Lieu de naissance

CANADA

Permanent Address – Résidence fixe

8315 - 120 ST
EDMONTON, ALBERTA
T6G 1X1

THESIS – THÈSE

Title of Thesis – Titre de la thèse

THE READABILITY OF HEALTH EDUCATION PAMPHLETS AS A FUNCTION OF DIFFICULT TECHNICAL TERMINOLOGY.

Degree for which thesis was presented
Grade pour lequel cette thèse fut présentée

MASTER OF NURSING

Year this degree conferred
Année d'obtention de ce grade

1985

University – Université

UNIVERSITY OF ALBERTA

Name of Supervisor – Nom du directeur de thèse

DR. HELEN SIMMONS

AUTHORIZATION – AUTORISATION

Permission is hereby granted to the NATIONAL LIBRARY OF CANADA to **microfilm** this thesis and to **lend** or **sell copies of the film.**

The author reserves other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

L'autorisation est, par la présente, accordée à la BIBLIOTHÈQUE NATIONALE DU CANADA de **microfilmer** cette thèse et de **prêter** ou de **vendre des exemplaires du film.**

L'auteur se réserve les autres droits de publication; ni la thèse ni de longs extraits de celle-ci ne doivent être imprimés ou autrement reproduits sans l'autorisation écrite de l'auteur.

ATTACH FORM TO THESIS – VEUILLEZ JOINDRE CE FORMULAIRE À LA THÈSE

Signature

Jane H Hopkinson

Date

October 2, 1985

NL-91 (r. 84/03)

Canada

THE UNIVERSITY OF ALBERTA

THE READABILITY LEVELS OF HEALTH EDUCATION PAMPHLETS AS A FUNCTION OF DIFFICULT TECHNICAL TERMINOLOGY

©

BY

JANE H. HOPKINSON

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
AND RESEARCH IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
MASTER OF NURSING
FACULTY OF NURSING

EDMONTON, ALBERTA
FALL 1985

THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR: JANE H. HOPKINSON

TITLE OF THESIS: THE READABILITY OF HEALTH EDUCATION PAMPHLETS AS A FUNCTION OF DIFFICULT TECHNICAL TERMINOLOGY

DEGREE: MASTER OF NURSING

YEAR THIS DEGREE GRANTED: 1985

Permission is hereby granted to THE UNIVERSITY OF ALBERTA LIBRARY to reproduce single copies of this thesis and to lend or sell such copies for private, scholarly or scientific research purposes only.

The author reserves other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

Jane H. Hopkinson.......

(Student's signature)

8315 - 120 ST.,.........

(Student's permanent address)

EDMONTON, ALBERTA, T6G 1X1

Date: October 2, 1985

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled THE READABILITY LEVELS OF HEALTH EDUCATION PAMPHLETS AS A FUNCTION OF DIFFICULT TECHNICAL TERMINOLOGY submitted by JANE H. HOPKINSON in partial fulfilment of the requirements for the degree of MASTER OF NURSING.

Helen Simmons

(Supervisor)

Phyllis Giovannetti

Frances M. MacCannell

Date: September 25, 1985

ABSTRACT

Nurses have an ethical responsibility to provide clients with adequate knowledge to make informed decisions concerning health care practices. The acquisition of knowledge however, depends on the ability of the recipient to understand the information being communicated. Pamphlets are one method by which health information is conveyed, but if one defines the average reader as having a grade 8 reading ability, the pamphlets must be prepared at a grade 8 or lower level of reading difficulty if they are to be understood by the public at large. The present study investigated the grade level of reading difficulty (readability) of 50 health education pamphlets, and identified the technical language in the pamphlets associated with the difficulty. Dale-Chall readability analysis indicated that nine of the 50 pamphlets had a grade 8 or lower readability level. After substitution of the difficult technical terminology, by synonymous terminology which would be understood at a grade 8 level, 24 of the revised pamphlets were readable at grade 8 or lower. The drop in mean readability scores between original and revised pamphlets was statistically significant. Five hundred thirty-two difficult technical words occurred one or more times for a total of 1642 occurrences. The difficult technical words recurring across four or more pamphlets made a statistically significant contribution to the high readability levels. The readability levels of pamphlets above and below grade eight were independent of difficult technical words which recurred four or more times within a pamphlet.

ACKNOWLEDGEMENTS

I would like to thank the members of my thesis committee: Dr. Helen Simmons, Dr. Phyllis Giovannetti and Dr. Frances MacCannell for their guidance as I worked (and often struggled) to learn the research process. A special thank you is offered to Dr. Simmons for her patience throughout the development and completion of the thesis.

I am particularly grateful to Pat Hayes and Carol Gray for their conscientious assessment of the study material. I also wish to express my appreciation to the Edmonton Local Board of Health, for the use of their resources and for the co-operation I received throughout the study.

I would like to acknowledge the help of the University of Alberta consultants in statistical application, especially Dr. Layne Marshall for his advice whenever requested.

Last, but most certainly not least, I thank my family for their interest and encouragement at every stage of the thesis. Geoff especially, was my stalwart support.

CONTENTS

CHAPTER PAGE

I. INTRODUCTION 1
- Statement of the Problem 1
- Purpose 4
- Conceptual Framework 5
- Vocabulary and Syntax Variables in Readability Analysis 10
- Formula Measurement of Readability 19
- Health Education Readability Research 35
- Rewriting to Reduce Readability Levels 41
- Operational Definitions 43
- Hypotheses 44

II. DESIGN: SUBJECTS AND PROCEDURE 47
- Subjects 47
- Procedure 53

III. THE DATA AND THEIR TREATMENT 60

IV. DISCUSSION OF THE RESULTS 82
- Discussion 82
- Conclusions 95

V. SUMMARY 106

REFERENCES 110

APPENDIX A 116

APPENDIX B 122

APPENDIX C 143

APPENDIX D 147

LIST OF TABLES

		Page
Table 1	Identification Code, Titles and Frequencies of Preventative and Restorative Sample Pamphlets	51
Table 2	T-test Comparison of Mean Percentage of Difficult Technical Terminology In Preventative and Restorative Health Education Pamphlets	52
Table 3	Dale-Chall Readability Scores (D/C), Percent per passage of Unfamiliar Words (%UFW) and Difficult Technical Words (%DTT); Mean Sentence Length (S/L); and Grade Level Equivalent of Preventative Health Education Pamphlets	63
Table 4	Dale-Chall Readability Scores (D/C), Percent per passage of Unfamiliar Words (%UFW), and Difficult Technical Words (%DTT); Mean Sentence Length (S/L); and Grade Level Equivalent of Restorative Health Education Pamphlets	66
Table 5	Pearson Product Moment Correlation Between Dale-Chall Readability Scores (D/C) and Percentage of Difficult Technical Terminology (% DTT) in Preventative and Restorative Health Education Pamphlets	70
Table 6	T-test Comparison of the Mean Sentence Length (S/L) Between the Original and Revised Forms of the Preventative and Restorative Health Education Pamphlets	73
Table 7	Dale-Chall Scores (D/C-O) (D/C-R), Percent per passage of Unfamiliar Words (% UFW), and Difficult Technical Words (% DTT), and Mean Sentence Length (S/L) of Original and Revised Preventative Health Education Pamphlets	74
Table 8	Dale-Chall Scores (D/C-O) (D/C-R), Percent per passage of Unfamiliar Words (% UFW), and Difficult Technical Words (% DTT), and Mean Sentence Length (S/L) of Original and Revised Restorative Health Education Pamphlets	75

Page

Table 9 Analysis of Variance for Repeat Measures Between Mean Dale-Chall Readability Scores of Health Education Pamphlets in Original Form and After Revision, for Preventative and Restorative Samples 77

Table 10 Chi-Square Test for Independence Between Dale-Chall Readability Scores of Preventative Health Education Pamphlets and the Inter-Pamphlet Recurrence of Difficult Technical Words 78

Table 11 Chi-Square Test for Independence Between Dale-Chall Readability Scores of Preventative Health Education Pamphlets and the Intra-pamphlet Recurrence of Difficult Technical Words 79

Table 12 Chi-Square Test for Independence Between Dale-Chall Readability Scores of Restorative Health Education Pamphlets and the Inter-pamphlet Recurrences of Difficult Technical Words 80

Table 13 Chi-Square Test for Independence Between Dale-Chall Readability Scores of Restorative Health Education Pamphlets and Intra-pamphlet Recurrence of Difficult Technical Words 81

LIST OF FIGURES

		Page
Figure 1	Framework of Reading Comprehension	6
Figure 2	Dale-Chall Readability Scores and Equivalent Readability Grade Levels	27
Figure 3	Scattergram of the Relationship Between Dale-Chall Readability Scores and the Percentage of Difficult Technical Terminology in Preventative and Restorative Health Education Pamphlets	69

CHAPTER I

INTRODUCTION

Statement of the Problem

The belief that health teaching is an inherent function of nursing goes back to Florence Nightingale (1859/1980) who instructed that the health of the nation depended upon womankind, that women should be instructed in the art of health, and that the person to best accomplish the instruction was the nurse. Despite her conviction that nurses ought to be teachers, she lamented that nursing does "little more than the administration of medicines and the application of poultices" (p. 6). By the early twentieth century however, nurses were receiving more formalized education than had previously been available to them, and with this education, were able to offer more skilled and specialized services. In Canada, as elsewhere, efforts were made to regulate nursing practice and education, and in 1908, the Canadian Nurses' Association was formed (The Leaf and The Lamp, 1968).

Pellegrino and Thomasma (1981) demonstrate the extent of the changes in nursing practice. When they describe the changing relationships which physicians have with patients, hospital and community, they note that as the concept of a health care team has been expanded, "the physician in the last decade has been compelled to share authority and functions with other health care professionals" (p. 161), including the relinquishing of the education and instruction of the patient. The nurse, as a member of that health care team has, in large part, assumed the educational role. The Canadian Nurses' Association has provided the vehicle whereby nursing has evolved into an autonomous profession, with established standards of practice (1980) and a Code of Ethics (1985), both of which recognize the responsibility of nurses to ensure that clients understand their health care management. This responsibility is typified in Standard III where it is stated that the nurse "determines the client's understanding of the helpfulness of the relationship in terms of the health service being perceived as understandable, manageable and meaningful" (p. 11). The nursing profession now practices the health teaching advocated over 100 years ago by Nightingale.

In meeting this teaching responsibility, nurses use many audio-visual aids, of which health education pamphlets are one of the most common. The potential benefit of written educational material is known, since studies show that adults do try to use pamphlets to learn more about health (Konheim & Naiman, 1954; Morris, Maxis & Gordon, 1977; Turner, Irwin & Roy, 1981; Morris & Olins, 1984). However, this potential can be realized only if readers can understand what they are reading.

Three facts indicate that readers may not understand written health communications. The first relates to the Canadian Association of Adult Education declaration that more than eight years of schooling is necessary for an adult to be functionally literate (Morrison, 1975), while the 1981 Canadian Census reveals that 20% of the population over 15 years of age have less than a grade nine education, and are therefore probably unable to read, write and understand at a basic level needed to function adequately in society. Secondly, an unknown portion of the adult population, who have at least a high school education are unable to read well enough to understand simple instructions provided to them in health care clinics (Wingert, Grubbs & Friedman, 1969; Doak & Doak, 1980). In a recent study, Glazer-Waldman, Hall and Weiner (1985) showed that only 40% of 81 hospital in-patients could read at a 6th grade level or higher. Although they did not report the educational attainment of the patients, it is probable that at least some of these adults had completed secondary schooling. Lastly, studies indicate that words associated with health, and used in discussions with clients about health-related matters, are often not understood by those clients (Samora, Saunders & Larson, 1961; Boyle, 1970; Tring & HayesAllen, 1973; Smeltzer, 1980). When nurses use written materials as teaching aids, they must realize that one or more of these reader limitations might affect the comprehensibility of the material for the reader.

One factor influencing the comprehensibility of written materials is the readability of the material itself, here defined as all of the physical attributes of written material which make it difficult or easy for a person to understand (Harrison, 1980). An interest in the readability of written material dates back to at least 900 A.D. when Talmudists were counting the words and ideas in the Torah in order to find out how many times each word appeared, and how frequently each word appeared in an unusual way (Klare, 1963). Although educators continue to study the structure of written material, present knowledge and technology now make it possible to use an objective measure to calculate a level of difficulty of the material. This level of reading difficulty, referred to as the readability level, indicates the predicted grade level of education required by a given reader in order to understand the material as written.

If nurses have available to them, the results of readability analysis as an indication of the readability levels of health education pamphlets, they can predict roughly how difficult particular materials will be for an intended reader to understand. Furthermore, if the health-related words in the pamphlets raise the readability levels, and hence make the pamphlets hard to understand, then the nurse selecting and/or preparing informational materials, will know such words should be avoided or given supplementary explanation. It behooves nurses therefore, to concern themselves with the readability levels of health education pamphlets, and the contribution of the health-related vocabulary to readability of those pamphlets, in order to ensure that clients using the pamphlets in the hope of making informed decisions about their own health care can, in fact, do so.

Purpose

The purpose of this study was to examine the contribution of difficult technical language to the readability of health education pamphlets in use, and thereby add to the general body of knowledge concerning the comprehensibility, and therefore usefulness, of pamphlets as a means of educating the public on health matters. The study was deemed to have practical significance for all health professionals (including nurses) nurses who intend to supplement or reinforce their health teaching using written material, or who must prepare or judge health education materials useful to the average person. The words "average reader", "technical terminology", and "difficult technical terminology" as they were used throughout the study, were defined as follows.

The phrase "average reader" as used in the study meant one who was able to read and comprehend at an educational attainment of grade eight. "Technical terminology" was defined as words having their only meaning in the field of health, or having a specialized meaning when applied to the health field (Dale & Tyler, 1934), and "difficult technical terminology" was technical terminology which is incomprehensible to the average reader.

Conceptual Framework

This study was based on a framework of reading comprehension. Three components comprise the framework. The first component is the attributes of the reader. These attributes are maturity, cultural influences, intelligence and reading skill. The second component is the response of the reader to the specific situation, influenced by the conceptual experience, anxiety and motivation of the individual at the time of reading the material. The last component of the framework is the readability of the material, comprised of vocabulary, syntax and legibility of the material. The three components all interact to influence how, or if, the reader will comprehend written instruction. Readability is the component of the framework upon which the present study was focused, with singular emphasis placed on the vocabulary in the material. The framework is pictorially presented in Figure 1, page 5. A brief discussion of the various aspects of reading comprehension will serve to place the readability component in context.

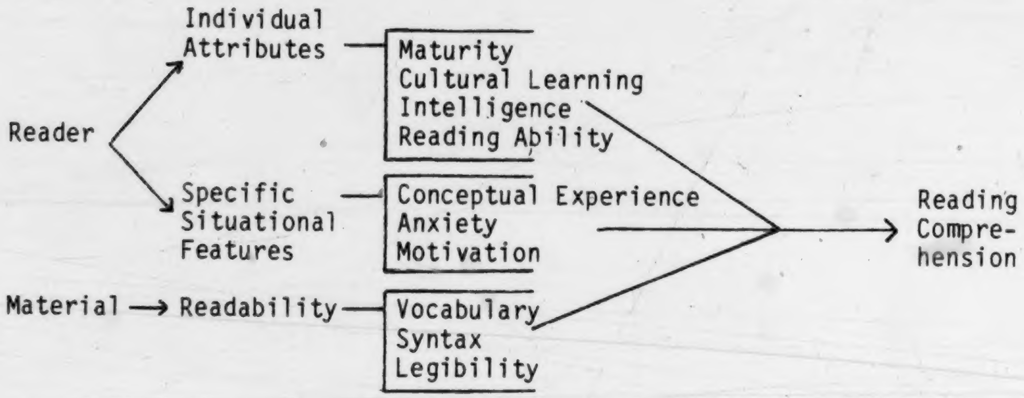

Figure 1. Framework of Reading Comprehension

To 'comprehend' material is "to understand or perceive the meaning" of it (Oxford, 1971). Huus (1971) suggests that the first stage of understanding written material is a literary one, where the reader views the work as a total unit and is able to paraphrase the author's ideas. The first stage is followed by a process of interpretation, where the reader is able to deduce from the material, what the general implications are for thought and action, if the reader wishes to benefit from the information gained through reading. The third stage, the assimilation of the material is the optimum stage, where the reader is able to use the information gained through reading, to make an informed choice on behalf of self or another, as to what, if any, a course of action to take to promote the optimum state of health for that individual. Obviously, it is desirable to develop health education pamphlets, from which the average reader can assimilate meaning, thereby maximizing the opportunity in the material for knowing about, and taking action with regard to matters pertaining to health.

According to the framework, it can be seen that the reader brings to the reading the inherent personal qualities of: maturity derived from experience which Oscar Wilde identified as "a question of instinct about life" (Pearson, 1960); cultural behavior influencing the response of an individual with regard to the acceptance and management of health related situations; reading skill which might be better or worse than indicated by the number of years of education of an individual; and intelligence, a factor which will in large part, determine the success of a person in any approach to the management of health.

As well as the inherent characteristics of an individual, the individual's ability to understand written materials depends on particular features relevant to the specific situation. The first feature to be described is anything in the situation which calls up previous conceptual experience. "A concept involves a response to the similarities among a series of experiences and to the range of variations in such instances" (Amster, 1965, p. 43). The concepts of childhood are developed as the child assigns meaning to words describing familiar objects or experiences. From the specific word meanings, generalizations are then made to other situations having similar characteristics, with the result that words come to take on expanded meaning. Ultimately, a person can abstract the characteristics of a new experience and assign it meaning based on memory of similar events. It is at this stage that a concept has formed. It is not difficult to imagine how confusion might arise for a reader of information related to health, if that person has not had an opportunity through familiarity, to form concepts about the material under study.

One example of conceptual confusion with health-related terminology described by Wilson and Hogan (1983), is associated with four common meanings for the word "drink". These meanings are: "liquid for swallowing"; "liquor"; "to take water"; and "to use alcohol". Hence the warning "not to drink" while taking a medication might easily be misinterpreted. Caron (cited in Knutson, 1965) also gave evidence that readers can become confused by medically associated concepts. He discovered that patients on a low sodium diet could not find peanut butter in the index of a diet manual, because it was listed under 'Fats' - an association, or implication for thought and action, which they did not know. Familiarity with concepts obviously may influence the degree of comprehension attained by reading.

Another feature which will influence how a person responds to a particular situation, might be the motivation of the reader to comprehend a health education pamphlet. For example, an individual might be motivated to learn more about a health related subject because of an interest in the subject, or a sense of responsibility to family members to understand a condition. If an eagerness to learn is present in the reader, there is more likely to be perseverance to continue reading difficult material, despite an inability to fully understand it (Klare, 1976). A de-motivating effect might also result when an individual is faced with complex instructional materials (Redman, 1980), or has no desire to improve upon a current situation.

Similarly, according to Redman, the anxiety a reader associates with an event, can be sufficient to influence a need to read and learn as much as possible. Conversely though, anxiety levels caused by fear of knowing the 'truth' about a condition, might become so high in an individual, that any opportunity to learn more about the condition is avoided.

By contrast with the unique characteristics each person brings to the reading of written material, the readability component of the framework is based on factors which remain static, and are the same objective stimulus for all readers. The comprehension of educational pamphlets by a reader will be influenced by the material readability factors of: vocabulary, whether familiar, or unfamiliar and unexplained; the syntax, whether concise and clear, or structurally complex; and the physical appearance (legibility) of the material, whether it contributes to, or interrupts the flow of reading.

In summary, the components of the framework of reading comprehension comprising the reader attributes, situational influences, and readability depend on: factors within the individual beyond individual control, such as intelligence; factors in the individual inside the individual's power to control, such as the choice whether to persist with reading particular material; and factors outside the individual and outside the individual's power to control, such as the physical attributes of the material to be read. It is apparent that each person will interpret, and learn from written material to a different degree, as a function of such factors and their interaction.

The readability of the material is one composite factor which is outside the individual, and outside the individual's power to control. Since the focus of the present study was on the readability of health education pamphlets, a discussion of two of the variables used in readability analysis, followed by a description of the use of readability formulae, which are typically used to measure readability levels, is in order.

Vocabulary and Syntax Variables in Readability Analysis

Chall (1958) suggests that the development of readability formulae can be divided into three general periods of emphasis. The first period from 1921 to 1928, emphasized the determination of the reading difficulty of written material based on one variable, that of vocabulary. During the second period of 1928 to 1938, investigators searched for factors other than vocabulary, which might be significant predictors of the level of reading difficulty of written material. The third period, beginning in 1939, marked the beginning of formula development, using the elements associated with the variables of vocabulary and syntax taken together.

Currently most readability formulae rely on the assessment of the two variables vocabulary and syntax. When these variables, within passages of written materials, are analyzed, the approximate grade level of reading ability required by a reader in order to understand the meaning being communicated, can be determined with some degree of success. Thus, if a passage is scored as having a grade eight readability level, those readers with a reading ability of grade eight or above should be able to understand it. Those with less than a grade eight reading ability will probably find the material too difficult to understand. To justify the use of vocabulary and syntax in readability analysis, the purpose of the early research was to determine which variables should be included in a readability formula.

The original studies designed to determine the variables for inclusion in a readability formula, depended on correlations between grade levels of readers successfully completing tests of comprehension on selected passages of written material, and the presence or absence in the passages of the specific variables being studied. One reported study of this kind was conducted by Dale and Tyler (1934). They analyzed 74 newspaper articles, each of which discussed health issues and consisted of approximately 400 words. The criterion of comprehension used was a multiple choice test, designed to identify the elements in the articles which contributed to the difficulty a reader had in understanding the materials. This test was administered to 60 adults. The final analysis of the elements identified as difficult for the reader to understand, revealed a medium negative correlation (r=-.46) held between test scores and the number of unique technical words in the passage. Since Dale and Tyler used as their definition of technical words, the same definition being used in the present study, that is, words having their only meaning in the field of health, or having a specialized meaning when applied to the health field, their results provided early evidence that the health-related words in written material are a source of difficulty for the reader trying to understand the material. The next highest correlation (r=-.37) held between the test scores and the non-technical, hard-to-understand words, defined by Dale and Tyler as words which did not appear on a list of words which were known to be understood by a clearly specified group of readers. (Word lists are described in more detail on page 15). The third highest correlation (r=-.34) held between test scores and number of prepositional phrases in a sentence. The results of Dale and Tyler, while valuable as an indicator of the role of vocabulary and syntax in readability analysis, also indicate that the technical language of health presents a special difficulty for reader comprehension.

Gray and Leary (1935) also studied the vocabulary and syntax elements which influence comprehensibility. Using samples of forty-eight passages of approximately 100 words each, selected from books, magazines and newspapers widely read by adults, Gray and Leary administered comprehension tests to 756 adults. The test results enabled the researchers to identify five elements which yielded correlations of .50 or better with the readers' comprehension test score results. The five elements were: average syllable length in words (r=-.52); number of easy words (identified as words which were familiar to adult readers) (r=.51); number of words not known to 90% of those tested (r=-.51); number of different hard words (identified as words which were unfamiliar to adult readers) (r=-.50); and average sentence length in syllables (r=-.50). The Gray and Leary results support the findings of Dale and Tyler (1934), and subsequent studies using different populations have yielded similar results (Bormuth, 1966; Coleman, 1971), justifying the general conclusion that elements associated with vocabulary and syntax do indeed influence reader comprehension, and are therefore appropriate to include in a readability formula as predictors of reader comprehension.

Two factor analysis studies of the data of Gray and Leary were conducted by Brinton and Danielson (1958) and Stolurow and Newman (1959). The Brinton and Danielson factor analysis revealed that the elements identified by Gray and Leary, loaded on six factors. Of these, Factor I dealt with words and was labelled a 'vocabulary factor'. Elements dealing with syntax exhibited a high loading on Factor II, called the 'sentence factor'. These investigators did not identify the other factors, nor report the portion of variance accounted for by each factor, so one is unable to judge the implications of the findings.

However, the second study, that of Stolurow and Newman (1959), found similar factor loadings. In their case, Factor I, labelled 'relative difficulty of words' accounted for 34% of the total variance, and Factor II, 'relative sentence difficulty', for 20% of the total variance. No other factors accounted for more than 8.2% of the total variance. With the 54% variance contributed by vocabulary and syntax in the Stolurow and Newman factor analysis, and the apparently high percentage of variance contributed by these same two variables, as identified by Brinton and Danielson, further support is provided for the inclusion of vocabulary and syntax in a readability formula, designed to predict reader comprehension.

More recent studies which have demonstrated support for use of vocabulary and syntax as indicators of readability of written material, are those by Bormuth (1966) and Coleman (1971). Both of these investigators were attempting to identify vocabulary and sentence elements which had not previously been included in readability formulae. Bormuth, studying the relationship between 47 vocabulary and syntax elements and passage readability levels, found that the highest correlation (r=.81) held between number of letters per independent clause and the readability level of a passage. Coleman, who studied 32 elements and their relationship to passage readability levels, demonstrated that the highest correlation (r=.90) held between readability levels and each of two elements - the number of letters in the passage and the number of syllables in the passage.

As in the factor analysis studies by Brinton and Danielson (1958) and Stolurow and Newman (1959), factor analysis by Entin and Klare (1978) of the vocabulary and syntax elements identified by Bormuth (1966) and Coleman (1971) as indicators of readability of written material, accounted for variances of 56.3% and 54.4% respectively. These results contribute positively to the evidence that vocabulary and syntax can be considered predictors of the comprehensibility of written material, and their use in a readability formula is justified.

Factor analysis has been criticized because it involves a higher degree of subjectivity than is usually acceptable in a statistical test (Polit & Hungler, 1983). However, in the three factor analyses studies reported above, although they were conducted independently, the elements associated with vocabulary and syntax were revealed as substantial predictors of passage difficulty, thus supporting the use of these two variables as components of a readability formula.

The two most frequently used measures of vocabulary difficulty are word length and word familiarity. The first of these, word length, is calculated by a simple count of such elements as total number of syllables, number of one syllable words or number of polysyllabic words per 100 words. Use of word length measures has been supported by the results of Bormuth (1966) who established a correlation coefficient of r=.63 to hold between passage readability levels and the number of syllables per word in the passages, and by Coleman (1971) who obtained a correlation coefficient of r=-.88 between passage readability levels and number of one syllable words in the passages.

On the other hand, word familiarity as a measure of vocabulary difficulty, is usually determined using a word list (Chall, 1958). A word list is based on the premise that words on the list will be understood by a specified group of readers, and words not on the list will not be understood by those readers. While this seems to be an overly-simplistic way to determine the reading difficulty of a passage, research has demonstrated repeatedly that reader comprehension of a passage has a direct negative relationship with the number of words in that passage which are not on the particular word list under study. For example, Dale and Chall (1948) obtained a correlation coefficient of r=.68 between grade levels of selected passages from several types of material, and the number of words in the passages not on the Dale-Chall list of 3000 familiar words. Similarly, Bormuth (1966) obtained a correlation coefficient of r=-.68 between reader comprehension of reading test passages, and the number of words in those passages not on a Dale list of 769 familiar words.

Current linguistic research has expanded into study of many more complex vocabulary elements such as letter redundancy, which is the sequences of a pair of letters in a passage (Bormuth, 1966). However, even when these elements are included in correlational studies (Bormuth, 1966; Coleman, 1971), word familiarity and word length both continue to yield correlations ranging as high as r=-.90 (Coleman,

1971) with calculated readability of written material, indicating the comprehensibility of the material.

The measure of syntax most often employed in readability formulae, is one of sentence length. Flesch (1948) notes a correlation coefficient of r=.52 holding between sentence lengths and the readability levels of passages. Bormuth (1966) had similar results to those of Flesch, when he established that a correlation coefficient of r=.58 held between readability levels of passages, and the number of words in the sentences of the passage. Many writers including von Glaserfeld (1970-71), Harber (1979) and Irwin (1980) stress that these correlations might not accurately reflect the comprehensibility of sentences, since some short sentences can be hard to understand, and some long sentences can be easily understood. One therefore needs further justification for using a measure of sentence length in a readability formula.

It is the studies of Gray and Leary (1935), Bormuth (1966) and Coleman (1971) which demonstrate intercorrelations between more complex syntactical elements and sentence length. For instance, Gray and Leary (1935) obtained an intercorrelation of -.77 between sentence length in words and number of simple sentences. Bormuth (1966) showed an intercorrelation of .77 to hold between number of words per sentence and number of independent clauses in the sentence, and Coleman (1971) found a correlation of .66 to hold between the sentence length in words and the number of prepositional phrases in the sentence. Each of these studies provides supportive evidence for the inclusion in a readability formula, of a measure of sentence length as an indicator of the syntactical difficulty of a passage, in that simple sentences are regarded as easier to understand, than are sentences which contain complex elements such as independent clauses and prepositional phrases.

In a study aimed specifically at testing whether sentence length is a valid measure of syntactical complexity, Glazer (1974) used the Botel, Dawkins, Granowsky Syntactical Complexity Formula (1972) to analyze the passages from 73 books. This formula assigns numerical values to the various elements of a sentence, such as number of clauses or number of adjectives. A measure of syntax is calculated from the tally of all the values. Glazer reported a correlation coefficient of $r=.98$ between sentence length and syntactical complexity, and demonstrated that sentences were long because they contained noun modifiers, dependent clauses, nominalized verbs, deletions in co-ordinate clauses and clauses used as subjects. From these results, Glazer concluded that longer sentences do typically contain more syntactically complex elements.

Coleman (1962) studied whether long sentences were difficulty for readers to understand, by testing reader comprehension of three technical passages from a university textbook. The passages, each having an average of 23.2 words in ten sentences, were re-written twice - once to a long sentence version with six sentences averaging 38.7 words, and once to a short sentence version with 15 sentences averaging 15.4 words. Ninety university students completed a test of comprehension of the passage material, after reading one of the three versions. A significantly higher ($p < .05$) comprehension rate was attained by those students reading the passage with the shortest sentences, when compared with scores of those reading either of the other two versions. There was no significant difference between comprehension scores of those reading the original compared with the long sentence version. The conclusion one could draw from this study is that short sentences do contribute to increased comprehension of material, but as sentences become longer, they have less influence on comprehension. This is possibly because longer sentences do tend to be more complex as has already been demonstrated (Gray and Leary, 1935; Bormuth, 1966; Coleman, 1971).

The results of the sentence analyses by Bormuth (1966) and Coleman (1971), where complex elements such as number of co-ordinate clauses, or number of words per prepositional phrase were included, indicate that the simple measure of sentence length showed a highly correlated negative association with reader comprehension. Therefore, unless one is conducting complex linguistic research, a measure of sentence length incorporated into a readability formula, is a valid and economical approach to predicting the comprehensibility of the material (Coleman, 1971).

Klare (1963) noted that as the variables of vocabulary and syntax became accepted by reading experts as valid indicators of the comprehensibility of written material, research was directed to developing a valid readability formula to measure the level of reading difficulty of material using the measures of vocabulary and syntax. A readability formula is a predictive device used to ascertain a quantitative, objective estimate of the difficulty level of the written material (Klare, 1963). The turning point in the research to find a formula came in 1948 with publication of two formulae in particular, the Dale-Chall readability formula (1948), and the Flesch Reading Ease formula (1948). By 1980, Harrison stated that "the number of predictive readability formulae now constructed runs into hundreds" (p. 51). Of 'the hundreds' of formulae in use, five in particular were used in the British Schools Council research into readability of material at all levels of education (Lunzer and Gardner, 1979). These five, including the above-mentioned Dale-Chall and Flesch formulae, are now used in much of the readability research, including research into the readability of health education materials. A brief description of the five, presented in chronological order, will serve to identify what one should have in mind when looking for an adequate readability formula.

Formula Measurement of Readability

Of the five readability formulae used in much of the current readability research, the first to be developed was that of Flesch (1948). Flesch reasoned that an important factor contributing to adults' difficulty in understanding written material was the abstract language used. He then established that abstract words correlate highly (r=.87) with the number of syllables in the word. He concluded from this that the number of syllables in a passage would reflect the abstractness of the words in the passage, and would therefore indicate the difficulty that an adult reader would have in understanding the passage. Based on this conclusion, Flesch developed a readability formula which incorporates a measure of the vocabulary difficulty through a count of the number of syllables in a passage, and a measure of the syntax difficulty of the passage through a count of the average number of words per sentence. The resulting score after formula calculation is called the Reading Ease Score, which can range from one to 100. A difficult passage yields a score of below 50, and easier passages yield scores from 51 upwards. For those occasions where a grade level is required, Flesch developed a conversion table whereby one can determine an approximate grade level from the Reading Ease score. Flesch provides little detail on the establishment of grade level equivalents, but does report that the grade levels were derived from a comparison of grade levels of adults who answered tests of comprehension on current popular reading material, and the Flesch Reading Ease scores of that material. The standard error, in grades, of the Flesch Reading Ease formula is 0.85 (Powers, Sumner and Kearl, 1958), indicating that Reading Ease formula scores are within one grade of empirically determined passage difficulty. The stability and equivalent reliability and the concurrent validity of the Flesch Reading Ease formula have been demonstrated frequently (Klare, 1963), and the Reading Ease Score is easily calculated. This is the most widely used of the readability formulae (Harrison, 1980).

The other readability formula developed in 1948 was that of Dale and Chall. Dale and Chall reasoned that, since previous research had shown a strong negative relationship between reader comprehension of written material, and the number of words in the material which were not on a specific word list (Dale and Tyler, 1934; Gray and Leary, 1935), it is more rigorous to use a word list as a basis for readability analysis. This formula is based on a list of 3000 words, identified as being 'familiar' words, that is, words which were understood by 80% of fourth grade students given tests on their comprehension of the meanings of the words. (The total number of students tested is not reported.) The Dale-Chall readability formula incorporates the measure of vocabulary difficulty level through the calculation of the percentage of words in a passage which are not on the Dale-Chall list of 3000 familiar words, and the measure of the syntax difficulty level through a count of the average number of words per sentence. If a grade level is required, Dale and Chall did as Flesch had done, and provided a conversion table whereby a grade level can be determined from the Dale-Chall readability score. (The method by which Dale and Chall established the grade level equivalents is described more fully on page 26.) The standard error of the Dale-Chall readability formula is 0.77 (Powers et al., 1958), slightly lower than the Flesch formula, indicating that the readability results based on this formula are, as with the Flesch formula, within one grade of empirically determined passage difficulty. Many experiments have demonstrated the concurrent validity of the Dale-Chall formula, and these will be described more fully on page 31. No studies however, have reported its reliability. (This weakness in the formula is discussed more fully on page 28.) The Dale-Chall formula is less widely used than the Flesch formula, and the most frequent reason given for this, is the time required to check for the presence on the word list, of each word in a passage. On the other hand, the list of 3000 familiar words is helpful, if one is wanting to identify specific words which contribute to reader difficulty. In the opinion of many reading experts, this formula is the best available if one requires a readability level most closely predicting the amount of difficulty a reader will have with written material (Klare, 1963; Gilliland, 1972; Klare, 1976; Harrison, 1980).

Another of the five formulae frequently used in readability research is the FOG formula, developed by Gunning (1952). From his perception it is less time demanding to count the number of polysyllabic (three or more syllable) words in a passage than to count the total number of syllables in a passage, Gunning based the formula calculation on passages of 100 words, where the average number of words in a sentence is multiplied by the percentage of polysyllabic words in the passage. The instrument is popular with those who desire a quickly calculable formula for determining readability of material. However, Powers et al. (1958) identified a standard error, in grades, of 0.90, indicating that the FOG readability levels are just slightly within one grade level of empirically determined passage difficulty. Studies of the concurrent validity of the formula show that the grade levels yielded by the FOG formula are frequently higher than those yielded by empirically determined methods (Pauk, 1969; Muir, 1974). It has been speculated by readability experts (Klare, 1963; Harrison, 1980) that this is due to the fact that the formula does not discriminate between words which are hard to understand, but have only one or two syllables, and those which are easy to understand but are polysyllabic.

Another instrument meriting discussion, the Fry Readability Graph (1968), as the name implies, is not a formula. It is however, a device worth describing since it is used frequently in readability research. The readability score is determined from a measure of vocabulary difficulty, based on the number of syllables in a passage of 100 words, and syntax difficulty based on the average number of words per sentence. These two points are plotted on a graph, and the readability level is read directly from the graph. The standard error of the readability levels determined from the Fry graph is 0.89 (Klare, 1976) indicating that, as with the previously described formulae, the Fry readability levels are within one grade of empirically established passage difficulty. The graph has been shown to have a high degree of concurrent validity (Fry, 1968; Carver, 1974-75; Singer 1975) and it is easy to apply. Its major disadvantage is in the fact that readability cannot be determined unless one has a graph.

The last of the five instruments requiring description is the SMOG readability formula developed by McLaughlin (1969). This formula, derived from trial and error of measures in regression analysis, requires simply that a count be made of the number of polysyllabic (three or more syllables) words occurring in 30 sentences. The square root is taken of the number of polysyllabic words, and the resulting number added to the constant which was determined in the regression analysis - the number three. Although McLaughlin states that the formula has concurrent validity, there has been research which has demonstrated readability levels fluctuating widely from empirically determined passage difficulty (Muir, 1974), and McLaughlin himself admits that the formula has a standard error in grades of 1.5, indicating that the readability levels calculated with the SMOG formula might be as much as one and a half grades different from empirically established passage difficulty. Because it is easily and quickly calculated, the SMOG formula is used frequently by those doing research with health education materials. However, it must be noted that, unlike most readability formulae, which claim to yield a readability level whereby 75% of the material will be understood by a reader, the SMOG formula was developed on the basis of 100% comprehension by the reader. Consequently, if readability levels are calculated on one passage using several formulae, the SMOG readability levels tend to be about two grades higher than those of the other formulae.

As has been mentioned, each of these five instruments has been used in analyzing readability levels of health education materials. Some, such as the FOG and SMOG, are easily used, but fail to detect if a passage has short but hard to understand words. The standard error, in grades, of the FOG and SMOG formulae is higher than it is with other commonly used readability formulae, thus reducing the confidence one might place in these two formulae.

Of the other three instruments, tests have shown that a correlation: of r=.88 held between the Fry results and the Flesch Reading Ease scores (Pauk, 1969); of r=.85 held between the Fry results and the Dale-Chall readability scores (Pauk, 1969); and of r=.92 held between the Flesch Reading Ease formula and Dale-Chall readability formula (Klare, 1952). The choice from among the three instruments depends on the speed with which one must conduct the readability analysis, and the particular information required from doing the analysis. The Fry graph can be used quickly and with comparative ease. The Flesch Reading Ease formula uses the same measures as the Fry graph, but has a slightly lower standard error. While the Flesch formula is the most frequently encountered instrument used in health care research (Klare, 1963; Gilliland, 1972; Harrison, 1980), one could use this formula or the Fry graph with confidence when calculating the readability levels of written materials. One could however, also use the DaleChall readability formula with confidence, since this formula yields readability levels closest to the empirically determined grade levels of readers able to understand written material (Klare, 1963). Because the low standard error for the formula (.77), and because the DaleChall list of 3000 familiar words provides a measure for detecting the technical vocabulary in the pamphlets which would be hard for the average person to understand, the Dale-Chall readability formula was the instrument of choice to be used in the present study.

In developing the Dale-Chall readability formula (1948), Dale and Chall used reading tests for which grade levels were already available. They identified from these tests, the words which were not on the Dale-Chall list of 3000 familiar words, and determined that a moderately high intercorrelation (r=.68) held between the established grade levels of the passages and "words not on the list of 3000 familiar words". They also determined that a medium intercorrelation (r=.46) held between the established grade levels of the passages and "the average sentence length of the passage". Testing these and other combinations of variables in a multiple regression equation, they developed the final formula, incorporating the variance contributed by the two above-mentioned variables, and a constant representing the error variance of the equation. Rules for applying the formula, are to be found in Appendix A, page 116. The formula is:

D/C score = (0.1579 x %UFW) + (0.0496 x WDS/SENT) + 3.6365

where: 0.1579 is the constant representing the variance attributable to the unfamiliar words in a passage;

%UFW is percentage of unfamiliar words in a passage;

0.0496 is the constant representing the variance attributable to the average number of words per sentence in a passage;

WDS/SENT is the average number of words per sentence in the passage;

and 3.6365 is the constant representing the mean error variance.

To test whether the instrument was a valid measure of readability for adult material, Dale and Chall assessed 55 passages from materials used to teach about health. They obtained a correlation coefficient of r=.92 between the formula scores of the 55 passages and the mean judgements expressing the degree of difficulty of the passages, as made by the educators who taught from the material, and a correlation of .90 between the calculated readability scores and readers who could correctly answer 75% of questions about the material. In addition, they obtained a correlation coefficient of r=.90 between the formula scores calculated on 78 passages from foreign affairs articles and the mean judgements expressing the degree of difficulty of the passages, as made by social studies teachers.

The last stage in formula development was that of setting a grade level equivalency for each calculated formula score. To accomplish this, the grade levels of adults who had participated in the comprehension tests of the 55 passages were compared with the Dale-Chall readability scores of the passages. These Dale-Chall scores and the grade levels of adults who could answer 75% of the questions based on the passages correctly, are found in Figure 2, page 27.

Dale-Chall Score	Grade Level
4.9 or lower	4 or lower
5.0 - 5.9	5 - 6
6.0 - 6.9	7 - 8
7.0 - 7.9	9 - 10
8.0 - 8.9	11 - 12
9.0 - 9.9	13 - 15 (college)
10 or higher	16 (college graduate)

Figure 2. Dale-Chall Readability Scores and Equivalent Readability Grade Levels

Reliability and Validity of the Dale-Chall Formula

Two aspects of reliability, the stability and equivalence of the instrument, are of particular importance in a readability formula. The stability of any readability formula is dependent on the accuracy with which one researcher is able to analyze over repeated measures the elements associated with vocabulary and sentence length used in the particular formula, elements such as the number of syllables in a passage, number of words not on a word list, and the average number of words per sentence. The equivalence of a readability formula is dependent on how closely formula scores for the same sample of passages, calculated by different raters, match.

In the case of the Dale-Chall formula, the stability relates specifically to both the accuracy with which individual raters can independently identify and count words in a passage, which are not on the Dale-Chall list of 3000 familiar words, and the accuracy with which raters can calculate the average number of words per sentence in a sample passage. The equivalence of the Dale-Chall formula depends on the ability of all raters to interpret and use in the same way, the criteria for calculating the percentage of unfamiliar words, and to calculate the average number of words per sentence in a passage.

As was mentioned previously, no studies have been reported which tested the stability or equivalence of the Dale-Chall readability formula. Chall (1958) suggests that, since the formula is based on a word list, and is accompanied by clear and detailed instructions, the following argument can be made to support the reliability of this formula:

> We can infer that the closer the formula is to structural aspects of writing, the greater the analyst reliability is likely to be. . . . we would probably find high analyst reliability for those formulas which are based on some word list. However, the analyst reliability will also depend upon the clarity of the directions regarding inflections, proper names, and other factors (p. 61).

This defence of the formula was repeated to the investigator by Dr. Chall (personal communication, April, 1985), and apparently researchers have been willing to assume both the stability and equivalence of the instrument, based on such inferences. However, this assumption is not justifiable, since there is no assurance that the rules for identifying and counting unfamiliar words in a passage will be interpreted the same by one analyst using the formula repeatedly on the same passage, or by more than one analyst scoring identical passages. The question as to the degree of disagreement which might occur remains.

Similarly, it seems to have been assumed by researchers using the Dale-Chall readability formula, that the calculation of the average number of words per sentence would be determined accurately, by one analyst using the formula repeatedly on the same passage, or by more than one analyst when scoring identical passages. One might suggest that the stability of the sentence length component of the Dale-Chall formula can be defended to some degree on the basis that being able to do simple arithmetic is a common skill. However, since speed, a factor known to influence the choice of formula, and monotony tend to accompany simple tasks, the assumption of, as opposed to the calculation of, stability, is not justifiable. The results of England, Thomas and Paterson (1953), who tested the stability of the Flesch Reading Ease formula are a case in point. These researchers found that when one analyst twice calculated Flesch Reading Ease scores on 77 passages of 100 words each, the result was a reliability coefficient of r=.95 between first and second counting of the average number of words per sentence. Since part of the calculation of the Dale-Chall readability score is also based on the average number of words per sentence, some might argue that when using the Dale-Chall formula, one analyst would probably be able to count accurately, and consistently from one occasion to the next, the average number of words per sentence, but there is no guarantee that this would be so.

Similarly, the equivalence of the Flesch Reading Ease formula, was demonstrated by Hayes, Jenkins and Walker (1950) and England et al. (1953), when correlation coefficients ranging from r=.83 to r=.97 between pairs of analysts counting average number of words per sentence when scoring identical passages. Again, some might argue that raters would probably agree on an average sentence length measure when using the Dale-Chall formula, but there is no guarantee of this. Others would argue that inter-rater agreement that drops below r=.85 introduces an unacceptable level of error for most purposes.

The form of validity required to be established on readability formulae and which indicates whether a readability formula yields an accurate measure of the reading difficulty of a passage, is criterion-related concurrent validity. To establish the concurrent validity of a formula, it is necessary to demonstrate that the elements being measured by the formula, are factors significantly influencing the readability level of the material, and hence in establishing whether or not the material will be comprehensible to the intended reader - in this case, the average reader. For the Dale-Chall readability formula specifically, if concurrent validity is established, indications would be that the formula is measuring the unfamiliar words and the average number of words per sentence in the material, and the readability levels obtained from a Dale-Chall readability score can be, therefore, used to predict how comprehensible the material will be for the average reader.

The evidence for the concurrent validity of the Dale-Chall formula comes from cross-validation studies and experimental studies. In cross-validation studies, either judges or comprehension tests are used to make predictions, from the simplicity or complexity of the words and the length of the sentences in a passage, as to the grade level of readers who will understand the material. The predicted grade levels become the criteria against which the Dale-Chall score converted to grade level from the same material are judged. Several studies have been designed to correlate the Dale-Chall readability scores against either expert judgement or reader comprehension tests. Examples of these studies are those carried out by Chall and Dial (1948), Lee and

Belden (1966) and Jongsma (1972). Chall and Dial using the formula calculated Dale-Chall readability scores for the scripts of nine newscasts. Using tests of comprehension by 100 first year university students, of the newscast content, they obtained a correlation of r=-.74 between the calculated readability scores and the comprehension scores. In a study with a similar design, Lee and Belden (1966) obtained a correlation of r=-.75 between the Dale-Chall readability scores of eight university level psychology textbooks, and the response of 396 university students to comprehension tests about the textbook content. Jongsma (1972), using cross validation between the formula calculated Dale-Chall readability scores of school library books and the mean judgements of the school librarians of the grade level difficulty of the books, found a correlation of r=.68 to hold between the two. These correlations suggest that the grade levels calculated using the DaleChall readability formula are consistent with those predicted by judges or with actual tests, and that the formula therefore, yields a valid indication of the impact of hard to understand words and number of words per sentence, on the readability level of a passage.

In experimental studies designed to establish concurrent validity of a formula, the Dale-Chall score of a passage is again correlated against the external criterion of reader comprehension of a passage. In an experimental test, two or more comparable groups of readers are given different versions of the same material prepared with varying degrees of vocabulary and/or sentence difficulty. The concurrent validity of the formula is presumed when a statistically significant difference is demonstrated between groups of similar ability in the comprehension of the material.

Two experimental studies in particular have tested the concurrent validity of the Dale-Chall readability formula. The earliest one of these, an experimental study by Swanson and Fox (1953), prepared two versions of a company newspaper. The researchers do not state precise Dale-Chall readability scores, but do report that one version was prepared with a Dale-Chall readability grade level of 7-8, and a second version was prepared with a Dale-Chall readability grade level of 11-12. The two versions differed on a) number of syllables per 100 words, b) average length of sentences, c) the percentage of words not on the Dale-Chall list of 3000 familiar words, and d) the ratio of verbs to adjectives in the papers. Three judges determined that subject matter content of the two versions was the same. Before reading one of the two versions of the paper, the 130 subjects answered a ten item information test related to material in the newspaper. The test responses of the two groups did not differ significantly, indicating that all had about the same pre-test knowledge of the newspaper content. The subjects were then given one of the two versions of the paper to read, followed by a test with the same ten questions. On second testing, those assigned to read the easier version of the newspaper increased significantly in the total number of correct responses to the test ($p < .01$) and the mean number of correct responses increased from 5.25 (SD 1.82) to 8.03 (SD 1.91). Those answering questions on the harder version, did not show a statistically significant improvement in correct responses. These findings provide evidence that the Dale-Chall readability formula does predict changes in comprehensibility corresponding to changes in vocabulary and syntax difficulty as used in the formula.

The other experimental study was conducted by Klare, Mabry and Gustafson (1955) who used a design similar to that of Swanson and Fox (1953), the results of which also supported the concurrent validity of the Dale-Chall formula. This study involved use of three versions of a 1200 word Air Force study guide. As in the Swanson and Fox study, these researchers do not report the Dale-Chall readability scores of the material. They do report that the original version of the guide had a Dale-Chall readability grade level of 11 to 12. An 'easy' version was re-written to a Dale-Chall readability grade level 7-8; and a 'hard' version was re-written to a Dale-Chall readability level of college graduate. The differences between the versions were in a) percentage of frequently used words, b) average sentence length, c) proportion of abstract to concrete words, and d) the proportion of active to passive sentence constructions. All versions were judged by content experts, as having the meaning unchanged, and as including the same technical terms. The subjects, 989 Air Force inductees who were not familiar with the material, answered a 50 question multiple choice test after reading either the 'easy', 'hard' or original version of the booklet. Those answering questions about the 'easy' version had a mean number of 27.19 correct answers out of 50, those answering questions about the original version had a mean number of 24.69 correct answers out of 50, and those answering questions about the 'hard' version had a mean number of 23.07 correct answers out of 50. Analysis of variance of the mean number of correct answers, indicated that a statistically significant difference ($p < .01$) held between the 'easy' and original versions, and a statistically significant difference ($p < .001$) held between the 'easy' and 'hard' versions. As with the Swanson and Fox study, the results of Klare et al. indicate that since the material differed only in vocabulary and syntax factors, it is likely that the Dale-Chall readability formula results predicted the differences in the difficulty the readers would experience with each of the three versions.

These two experimental studies with the Dale-Chall readability formula indicate that if adjustments are made to the particular vocabulary and sentence variables of a passage, the formula will detect the changes and reflect these changes in the Dale-Chall scores. Furthermore, the cross-validation and experimental studies to affirm the concurrent validity of the Dale-Chall formula, provide strong evidence that a calculated readability level of a passage will be consistent with the relative comprehensibility to the reader of that passage.

The Dale-Chall readability formula gained acceptance by educators of many disciplines, who began using the formula as a method of determining whether material would be comprehensible to an intended adult audience. Reported studies using the formula include such diverse topics as the readability of: newspapers (Razik, 1969); income tax instruction (Pyrczak, 1976); footnotes to financial statements (Worthington, 1977); government brochures (Christ and Pharr, 1980); insurance forms (Trapini and Walmsley, 1981); and health care research, the area of interest relevant to this particular study.

Health Education Readability Research

In health education, the Dale-Chall readability formula has had only limited use for the analysis of the readability level of health education pamphlets. The reason for this may be that it is a time consuming device. Studies in this area which have been reported, using the Dale-Chall formula include those of Dale (cited in Dale and Hager, 1950), Thrush and Lanese (1962), and Leichter, Nieman, Moore, Collins and Rhodes (1981). Dale evaluated many factors contributing to the comprehensibility of teaching pamphlets related to tuberculosis. Although the precise number is not given, Dale and Hager note that "most" of the pamphlets were written at a grade 9 or higher level. Thrush and Lanese concentrated on studying the vocabulary in 47 diabetic teaching pamphlets, but while doing the study, established that 13 of 16 of the pamphlets were written at a readability level of grade 8 or higher. Leichter et al. studied eight diabetic teaching pamphlets, and found that six of these pamphlets were written with readability levels of grade 8 or higher. In a survey of the readability of family planning educational literature, Hopkinson (1983) found Dale-Chall readability levels higher than grade 8, in 20 out of 27 pamphlets intended for adults. In each of these studies, most pamphlets would be too difficult for a reader who is able to read at a grade 8 level, to understand.

Although using different readability formulae from the Dale-Chall readability formula, other studies have also revealed that the readability levels of health education pamphlets are typically higher than a grade eight level. The material found by these studies to be too difficult for the average reader to understand have included those studied by: Spadero (1980) who reports using the SMOG formula to establish readability levels on parent instructional pamphlets, although the scores in the accompanying table in the study reports Flesch Reading Ease scores; Liquori (1979) who applied the Flesch formula to study packaged patient inserts from four medication packages; Kahn (1978) who applied the Flesch formula to five pieces of drug abuse information; Ley (1972) who applied the Flesch formula to 25 explanatory x-ray leaflets; Bakdash, Odman and Lange (1983) who applied a computer program called the Minnesota Interactive Readability Program but did not identify what specific formulae were used. The readability levels of a cross-section of materials describing health care were studied by Holcomb (1981) using the Flesch formula on 15 pamphlets, Vivian and Robertson (1980) using the Fry, SMOG and FOG to study 44 pamphlets, Spadero, Robinson and Smith (1980) who studied 111 pamphlets using the Flesch Reading Ease formula, Doak and Doak (1980) who used the SMOG formula to study 100 pamphlets, and Freimuth (1979), who used the SMOG formula to study 20 pamphlets.

In all of the studies of the readability of health education pamphlets, indications are that most pamphlets intended to teach about health, would not be understood by the average reader, and one can conclude that the potential educational value of the material would not be realized by the user.

Although the consistently high readability levels of health education pamphlets has been demonstrated, and despite the research which indicates that words related to health are often not understood by the average person (Boyle, 1970; Tring and Hayes-Allen, 1973; Smeltzer, 1980), there have been relatively few reports in the literature about the relationship of the comprehensibility of health related literature, to the technical terminology contained therein. Dale and Tyler (1934) demonstrated the frequency with which health-related language appeared in popular reading material dealing with health issues, when they compiled a list of 1000 of these words which might be encountered by the average reader. This list did not indicate which words could be understood by readers at different educational levels, but it was a fore-runner of a later study by Dale (cited in Dale and Hager, 1950) into the health-related vocabulary in written material.

In this later study, Dale undertook a five year project to evaluate all aspects of the comprehensibility of 60 educational pamphlets used by the National Tuberculosis Association (cited in Dale and Hager, 1950). One of the factors which he studied was the vocabulary in the pamphlets. Based on the evaluation results, Chall and Dale (1950) compiled a list of 380 technical words which were categorized as to the percentage of the population who would be able to understand each word. One hundred sixty-two technical words or 43% could be understood by fewer than 55% of the readers, suggesting that much of the educational value of the pamphlets was lost. Although a useful list as a guide to difficult technical terminology, its major drawback was the fact that it had a specific emphasis; namely the literature was related to tuberculosis and, therefore, was not representative of the breadth of health-related pamphlets or technical terminology in common use in health literature.

Based on the results of the analysis of the tuberculosis teaching pamphlets, Dale and Hager (1950) prepared a booklet containing suggestions for writing materials intended to teach about health. They expressed the need for writers of technical materials to find the most effective way of presenting complicated, specialized concepts which require the use of technical language. They suggested that the technical vocabulary be supplemented with definitions in order "to provide opportunities for the abler reader to extend his scientific vocabulary, yet not put unnecessary hurdles in the path of the less able reader" (p. 18).

Dale and Hager continued their suggestions for writing health materials by warning against the unnecessary use of difficult non-technical words. They make the point that "a technical concept is hard enough to grasp without also including hard non-technical words to confuse the reader" (p. 19). They recommend that when an idea is relevant to the meaning of the passage, a word which is easy to understand be used, and they give as examples 'tired' instead of 'fatigued', and 'use' instead of 'utilization'.

Two readability studies which focused specifically on the difficult technical terminology in health-related information, were conducted by Thrush and Lanese (1962) and Pyrczak and Roth (1976) - both using the Dale-Chall (1948) formula. The study by Thrush and Lanese was based on a random sample of 143 passages from 47 pamphlets written about diabetes. The researchers isolated all of the "unfamiliar" words (words not on the Dale-Chall list of 3000 familiar words) which occurred four or more times in the 143 passages, by which they identified a total of 198 individual words as unfamiliar to the average reader. Although Thrush and Lanese did not identify any specifically technical words in their study, on inspection it seems that at least 115 (58%) of the words they identified as being unfamiliar have a health related meaning. From all 47 pamphlets, it was estimated that one word in five would not have been understood by the majority of persons for whom the material was intended. Unlike a later study by Pryczak and Roth (1976), the investigators did not try to improve the readability levels by word substitution.

The Pryczak and Roth (1976) study used the Dale-Chall formula to measure the readability of 'warnings' on non-prescription 'aspirin-type' drugs. The initial analysis revealed a readability level of grade 12. The directions were then re-written with the removal of five words: accidental, overdose, contact, physician, and immediately, which lowered the readability level to fourth grade. A similar result was demonstrated with the 'caution' section on the same drugs was re-written and reduced to fourth grade from a thirteenth grade readability level. The words removed this time were: persists, redness, arthritic, rheumatic, conditions, affecting, consult, physician, immediately. The trust that one can put in these results is questionable however, since the Dale-Chall formula is intended to be applied to passages of at least 100 words, and the first sample analyzed had only 18 words and the second sample had 30 words. Although sentence length is weighted less heavily than is the vocabulary measure in the calculation of the Dale-Chall formula, the possibility also exists that the apparently lowered readability levels resulted from an altered sentence length.

The researchers do not acknowledge having changed the syntax, but it is apparent on inspection that the sentences are shorter and less complex. Although the study was not examining the readability levels of pamphlets, the emphasis on the vocabulary used in 'warnings' on drug labels, yields data suggestive of the fact that further testing of the influence of vocabulary on the readability levels of written pamphlets would be valuable.

Since average sentence length as a component of readability, also contributes to comprehensibility, it is in order to comment on the research regarding number of words per sentence in health education pamphlets. Dale and Hager (1950) touch briefly on the importance of keeping sentences short if they are to be easily understood, while warning that artificially short, choppy sentences can also detract from the comprehensibility of material. They recommend that the average sentence length for materials teaching about health should be about 20 words. Although they do not provide a reason for this recommendation, one could surmise that it is because Dale (cited in Dale and Hager, 1950) determined this to be a comprehensible sentence length during his evaluation of the 60 pamphlets from the National Tuberculosis Association.

In summary, the research related to the readability levels of written health education information indicates that these materials are prepared at a readability level higher than grade eight, and hence are typically too difficult for the average reader to understand. From preliminary studies, there are indications that the presence of technical terminology in the written materials might be a factor in readability levels higher than grade 8. If so, the logical conclusion would be that materials could be revised to lower their readability levels by reducing the number of difficult technical words. However, altering the material in this way requires care be taken if one is to reduce the readability levels, while retaining the meaning and continuity of the information (Klare, 1963; Dale and Chall, 1965; Harrison, 1980).

Rewriting to Reduce Readability Levels

Dale and Chall (1965) note, readers do not always read at the level at which they are capable, but tend to seek material which is easily understood. Thus while the ability to read at a grade eight level is regarded as necessary before an adult is considered functionally literate (Morrison, 1975), reading experts suggest that to ensure that a reader can understand material, it should be written at one to two grade levels below the reading ability of the reader (Klare, 1963; Dale and Chall, 1965; Flesch, 1974). Based on this recommendation, if health education pamphlets are to be understood by the average reader, they should be prepared with a readability level of grade six or seven.

When a readability formula indicates that a pamphlet will be incomprehensible to the average reader, the reduction in the readability level can best be achieved by a total rewrite of the material, with emphasis on vocabulary that is easy to understand, and on short sentences. However, Dale and Chall (1965) suggest that if readability levels are caused primarily by incomprehensible words which have a more comprehensible equivalent, then straight word for word substitution should be successful to increase the comprehensibility of the material for the average reader.

Duffelmeyer (1979), in a study designed to test whether vocabulary substitution alone would improve the comprehensibility of written material, replaced all abstract nouns and verb nominalizations with concrete nouns and full verbs. Duffelmeyer reports that the syntax of a sentence was left unchanged, except for adjustments in sentence length by replacement of words, but he does not report the number of extra words required for those adjustments, nor whether any attempt was made to hold sentence length constant for calculation. Using 72 college students as subjects, he administered tests of comprehension of the material. The results indicated that readers understood the simplified material better than did a control group who had the material in the original form ($p < .01$). Although one cannot judge the importance of the altered sentence length on the results of comprehension testing, it would appear that, by simplifying the vocabulary which he had identified as hard to understand, namely abstract nouns and verb nominalizations, and leaving syntax unchanged, Duffelmeyer did show that reader comprehension of material could be improved to a statistically significant level. It seems reasonable therefore, to argue that if nothing except the words in a passage which are identified as contributing to reader difficulty are changed, and the readability level of that passage goes down, then the difference must be attributable to vocabulary.

In summary, if one is attempting to reduce the readability levels of written materials, those materials should be prepared with readability levels of grade six or seven if they are to be understood by the average reader, and they can be made easier for a reader to understand through substitution of words which are difficult to understand with words which are understood by the average person.

It will be recalled that the summary of the research related to the readability levels of written health education information indicates that most written materials are prepared at a readability level higher than grade eight, and hence are typically too difficult for the average reader to understand. In addition, it will be recalled that preliminary studies indicate that the presence of technical terminology in the written materials appear to be a factor contributing to readability levels higher than grade 8. It remained to study whether in fact there was a relationship between the readability levels of health education pamphlets and the difficult technical terminology in the pamphlets, and whether the readability levels of the pamphlets could be reduced if they were prepared using technical terminology which could be understood by the average reader. In order to investigate these possibilities in the study, the following operational definitions were used.

Operational Definitions

"Technical terminology" is language having its only meaning in the field of health, or having a specialized meaning when applied to the health field (Dale and Tyler, 1934), and as delimited by words which appear in the Stedman's Medical Dictionary.

"Difficult technical terminology" is technical terminology which is not on the Dale-Chall list of 3000 familiar words, and is therefore designated as unfamiliar for the average reader.

"Recurrent difficult technical terminology" is difficult technical terminology which recurs four or more times within or across pamphlets.

"Readability level" is a Dale-Chall readability score converted educational grade level required by a reader in order to understand 75% of the material being read, and is attained by converting a Dale-Chall readability score to grade level.

"Readability formula" is the instrument used to measure the Dale-Chall quantitative, objective estimate of the readability level of written material.

Hypotheses

In order to pursue the purpose of the study, to determine the contribution to the readability level of health education pamphlets, made by the difficult technical language of those pamphlets, the empirical hypotheses for the study were:

1) The readability level of health education pamphlets, as a factor in the comprehensibility of the pamphlets for the average reader, is influenced by the number of difficult technical words contained in them.

2) The readability level of health education pamphlets, as a factor in the comprehensibility of the pamphlets for the average reader, can be lowered by substituting familiar synonyms for the difficult technical words used in the pamphlets.

3) The readability level of health education pamphlets, as a factor in the comprehensibility of health education pamphlets for the average reader, is dependent in part, on specific technical words which recur within and across pamphlets.

Stated statistically, these hypotheses were:

Hypothesis 1

1) Ho: There is no relationship, between the readability levels of health education pamphlets, and the percentage of difficult technical terminology contained in the pamphlets, under Pearson Product Moment Correlation analysis ($p \leq .05$).

Ha: There is a direct positive relationship between the readability levels of health education pamphlets, and the percentage of difficult technical terminology contained in the pamphlets, under Pearson Product Moment Correlation analysis ($p \leq .05$).

Hypothesis 2

2) Ho: There is no difference between the readability levels of health education pamphlets, in the presence versus absence in the pamphlets, of difficult technical terminology, under analysis of variance for repeat measures ($p \leq .05$).

Ha: There is a decrease in the readability levels of health education pamphlets, following substitution of the difficult technical terminology contained in the pamphlets, by synonymous technical terminology found in the Dale-Chall list of 3000 familiar words, under analysis of variance (one tail) for repeat measures ($p. \leq .05$).

Hypothesis 3

3a) Ho: There is no relationship between the readability levels of health education pamphlets and the interpamphlet recurrence of difficult technical words, as measured by the occurrence in four or more pamphlets, of the same difficult technical word, under Chi-square test of significance for independent samples ($p \leq .05$).

Ha: There is a direct positive relationship between the readability levels of health education pamphlets and the interpamphlet recurrence of difficult technical words, as measured by the occurrence in four or more pamphlets of the same difficult technical word, under Chi-square (one tail) test of significance for independent samples ($p \leq .05$).

3b) Ho: There is no relationship between the readability levels of health education pamphlets and the intrapamphlet recurrence of difficult technical words, as measured by the occurrence four or more times per pamphlet, of the same difficult technical word, under Chi-square test of significance for independent samples ($p \leq .05$).

Ha: There is a direct positive relationship between the readability levels of health education pamphlets and the intrapamphlet recurrence of difficult technical words, as measured by the occurrence four or more times per pamphlet, of the same difficult technical word, under Chi-square (one tail) test of significance for independent samples ($p \leq .05$).

For purposes of testing all hypotheses: the Dale-Chall readability score was used as the measure of the readability level of the pamphlets; the Stedman's Medical Dictionary was used as the measure of technical terminology; and technical terminology not on the Dale-Chall list of 3000 familiar words was used as the measure of difficult technical terminology.

CHAPTER II

DESIGN: SUBJECTS AND PROCEDURE

Subjects

The population of materials to be sampled was comprised of 437 health education pamphlets, written in English and identified by the Health Promotion Division, Edmonton Local Board of Health, as having suitable content for adult readers in the general public. The criteria for inclusion in the population were pamphlets which described an action an individual could take on behalf of self or another to prevent organic or psychological dysfunction; and those which described an action an individual could take on behalf of self or another to restore an organic or psychological function, ie., correct a dysfunction.

Sample selection - pamphlets

In preparation for sample selection, a list was made of all of the pamphlets which met the criteria for inclusion (N=437). Logically, one expect that the pamphlets which described the everyday behaviors an individual could take on behalf of self or another to prevent organic or psychological dysfunction would have fewer difficult technical words than would those which described the "treatment" action an individual could take on behalf of self or another to restore an organic or psychological dysfunction. The investigator reasoned that if there were fewer difficult technical words in the pamphlets dealing with prevention, than in the pamphlets dealing with restorative care, then the pamphlets would represent separate populations with regard to the phenomenon under study; namely, readability. On this basis, the investigator identified and labelled the pamphlets dealing with preventive action as "Preventative", and the pamphlets dealing with restorative action as "Restorative". Each of the 437 pamphlets clearly qualified as either "Preventative" or "Restorative".

Power analysis (Cohen, 1977) of the data collected from ten pamphlets indicated that at a level of significance of .05, power .8 (which is the probability that the test will yield statistically significant results), and effect size .75 (which is the degree to which the phenomenon under study is manifested), the sample size required to meet the assumptions of the normal distribution was 23 pamphlets. Since the pamphlets were assumed to represent two populations, two subsamples of 23 pamphlets were required to test the effect of difficult technical terminology in the separate sub-populations. This number was rounded up to 25, requiring a final selection of 25 "Preventative" and 25 "Restorative" pamphlets.

Some subject matter groups included only a few pamphlets, and to ensure that the sample would include the topics most frequently addressed in the total population of pamphlets, the sampling frame comprised those pamphlets in subject matter groups representing 80% of the total population. Since the pamphlets represented various subject matters, stratified random sampling technique was used to obtain the total sample. Within each of the two groups of "Preventative" or "Restorative" pamphlets, the pamphlets were sub-divided according to subject matter. If a pamphlet had a dual focus it was assigned to the subject matter group which, in the judgement of the investigator, was the predominant theme of the material. As an unbiased method of listing subject matter headings, the investigator listed these alphabetically.

Two hundred and twenty-two pamphlets qualified as "Preventative". Of these "Preventative" pamphlets, six subject headings contained 179 pamphlets, representing 80.6% of pamphlets in the population. These six subject headings became the sampling frame for the "Preventative" group of pamphlets. The headings, and the number of pamphlets contained therein were: Family Planning, Pre-natal and Sexuality (16); Fitness (28); Mental Health (21); Nutrition (24); Parenting (32); Smoking, Alcohol and Drug Abuse (58). The remaining forty-three (19.4%) of 222 pamphlets which were outside the sampling frame, represented the topics of Aging, Cancer, Cardiovascular, Diabetes, Epilepsy, Immunization, Respiratory and Vision and were not included. The pamphlets retained under the above mentioned subject headings were numbered consecutively.

Two hundred and fifteen pamphlets qualified as "Restorative". Of these pamphlets, seven subject matter headings included 176 pamphlets, representing 81.8% of the pamphlets in the population. These seven subject headings became the sampling frame for the "Restorative" group of pamphlets. The headings, and the number of pamphlets contained therein were: Aging (15); Cancer (17); Cardiovascular (24); Communicable Disease (21); Diabetes (25); Mental Health (24); Respiratory (48). The remaining thirty-nine (18.2%) of 215 pamphlets which were outside the sampling frame represented the topics of Arthritis, Epilepsy, Hearing, Medications, Scoliosis, Parenting or Vision and were not included. The pamphlets retained under the above mentioned subject matter headings were numbered consecutively, and the Fisher and Yates (1948) table of random numbers was used to draw a stratified random selection of 25 pamphlets from each of "Preventative" the "Restorative" groups respectively.

The titles of the 25 "Preventative" and 25 "Restorative" pamphlets drawn are listed in Table 1, page 51. Further sampling was then undertaken to select the passages for analysis from within the two groups of sample pamphlets.

Sample selection - passages

The Dale-Chall readability formula is based upon selection of three sample passages, each approximately 100 words in length, from each pamphlet. This selection process was conducted using systematic sampling dictated by the formula $k=N/n$, (where, for each pamphlet, k=the sampling interval, N=the total number of paragraphs in the pamphlet, and n=the required number of sample passages).

To accomplish the sampling, the paragraphs were numbered from the introductory paragraph through to the end of the pamphlet. Since pamphlets have such diverse beginnings as a short poem, or a foreword describing the services of the pamphlet producer, the investigator selected as the beginning of the unit to be sampled, the first paragraph of the pamphlet which dealt in sentence form, with the educational content of the pamphlet. Titles, paragraph headings and the final sections which directed the reader to further help were excluded when counting the number of paragraphs in the pamphlet, and when counting the 100 word passages for analysis. Appendix B contains a random selection of five passages from the "Preventative" and five passages from the "Restorative" pamphlets. (Throughout the remainder of this study, the word "pamphlets" will be used when referring to the sample

TABLE 1

Identification Code, Titles and Frequencies of Preventative and Restorative Pamphlet Samples

Preventative Pamphlets (n=25)

Family Planning, Pre-natal, Sexuality - (PFP) (n=4)

PFP1 - IUD Intrauterine Devices
PFP7 - Fitness and Pregnancy
PFP11 - Chemical - Combination Methods of Birth Control
PFP13 - What is Natural Family Planning

Fitness - (PF) (n=3)

PF27 - You and Your Heart Rate
PF40 - Exercise at the Office
PF44 - Jogging the Right Way

Mental Health - (PMH) (n=2)

PMH48 - Coping with Family Life
PMH57 - Suicide

Nutrition - (PN) (n=3)

PN72 - Food and Your Heart
PN80 - Let's Talk About Nutrition
PN89 - Be a Wise Loser

Parenting - (PP) (n=6)

PP93 - When the Kids are Fighting
PP95 - Breast Feeding
PP104 - Keeping Fitness in the Family
PP105 - Will I Ever Sleep Again?
PP107 - Do You Know Your Child?
PP120 - We Want a Child

Smoking, Alcohol and Drug Abuse - (PS) (n=7)

PS128 - Aging and Alcohol Abuse
PS133 - Women and Alcohol
PS141 - Smoking, The Unconscious Act
PS 144 - Alcohol and Your Unborn Baby
PS160 - Let's Talk About Drugs
PS162 - Stay Real
PS176 - Second Hand Smoke

Restorative Pamphlets (n=25)

Aging - (RA) (n=3)

RA5 - Frequently Asked Questions about Alzheimer's Disease
RA10 - Foot Care for Older People
RA13 - Hearing and the Elderly

Cancer - (RC) (n=3)

RC16 - What About a Lump in the Breast?
RC28 - Breast Cancer
RC32 - Facts on Skin Cancer

Cardiovascular - (RCV) (n=6)

RCV33 - Facts about Congestive Heart Failure
RCV38 - Living With A Heart Ailment
RCV39 - Heart Attack
RCV43 - If Your Child has a Congenital Heart Defect
RCV45 - Varicose Veins
RCV49 - After a Heart Attack

Communicable Diseases - (RCD) (n=2)

RCD57 - What To Do If You're Bugged By Head Lice
RCD72 - AIDS

Diabetes - (RD) (n=4)

RD86 - Treat Your Feet With Care
RD96 - Let's Talk about Insulin
RD97 - Travelling with Diabetes
RD102 - Diabetes - A Manual for Canadians

Mental Health - (RMH) (n=3)

RMH107 - Tensions
RMH110 - Schizophrenia
RMH117 - What About Mental Illnesses?

Respiratory - (RR) (n=3)

RR141 - Common Respiratory Allergies
RR149 - Emphysema
RR154 - Chronic Cough

of pamphlets, and "passages" will refer to the three passages of approximately 100 words each taken together as selected from a pamphlet.)

Before proceeding with hypothesis testing, a test of significance was applied to determine whether the "Preventative" and "Restorative" pamphlets were in fact treated as one population with regard to the percentage of difficult technical terminology in the pamphlets, or whether they were in fact, separate populations requiring separate analyses. A t-test for independent means ($p < .05$) was used to compare the mean percentage of difficult technical terminology between the "Preventative" and "Restorative" groups of pamphlets. The obtained t value of these means is 2.42. The critical value of t (one tail test), df 48, and a level of significance of .05 is 1.68, allowing the conclusion that the mean Dale-Chall scores of the "Preventative" and "Restorative" pamphlets were significantly different at the 95% confidence level. These results are reported in Table 2, page 52. Based on the comparison of the mean percentage of difficult technical terminology in

TABLE 2

T-test Comparison of Mean Percentage of Difficult Technical Terminology (DTT) In Preventative and Restorative Health Education Pamphlets

Pamphlet Type	Mean Percentage DTT	SD	df	t	t_{95}	t_{99}
Preventative (n=25) Pamphlets	9.4	5.28	48	*2.42	1.68	2.40
Restorative (n=25) Pamphlets	12.7	4.25				

*Significant at the .05 level and beyond.

the "Preventative" and "Restorative" pamphlets, hypothesis testing was conducted on the two samples of pamphlets, as representing two distinct populations.

Procedure

The procedure designed to collect the data required to test the hypotheses was as follows: Dale-Chall readability scores of the pamphlets were determined for each pamphlet passage set; the difficult technical terminology in each pamphlet passage set was identified; the difficult technical terminology in each pamphlet passage set was replaced with synonymous terminology which can be understood by the average reader; and the Dale-Chall readability scores of the revised pamphlets was determined. Each stage of the procedure is described below.

Calculation of Dale-Chall Readability Scores

It will be recalled that the Dale-Chall readability formula was the instrument chosen to calculate the readability scores of the health education pamphlets. Further, the Dale-Chall readability score is based on a measure from the passages, of a vocabulary variable based on the percent of unfamiliar words in the passage (i.e. words not on the Dale-Chall list of 3000 familiar words), plus a syntax variable based on the average sentence length of the passage. The formula is:

$$D/C = (0.1579 \times \%UFW) + (0.0496 \times WDS/SENT) + 3.6365$$

where:

0.1579 is the constant representing the variance attributable to the unfamiliar words in a passage;

% UFW is percentage of unfamiliar words in a passage;

0.0496 is the constant representing the variance attributable to the average number of words per sentence in a passage;

WDS/SENT is the average number of words per sentence in the passage;

and 3.6365 is the constant representing the mean error variance.

A Dale-Chall readability score for each of the 25 pamphlets in the "Restorative" group and 25 pamphlets in the "Preventative" group was determined, by first identifying the unfamiliar words in the passages. This was accomplished by a 'Word Plus' (1982) computer program which contained the 3000 words on the Dale-Chall list, and which identified and counted all of the words not on the Dale-Chall list of 3000 familiar words. The number of unfamiliar words in a passage was then converted to a percentage of all of the words in the passage. Lastly, the average sentence length of the passage was computed using the Text Readability Estimation STAR program (Walker, 1979). This program yields a count of the total number of words in a passage, and the average number of words per sentence in that passage. The Dale-Chall score for each pamphlet was then calculated, based on the two measures: percentage of unfamiliar words in a passage; and the average sentence length of a passage.

Identification of Difficult Technical Terminology

The Stedman's Medical Dictionary was chosen as the frame of reference for identifying difficult technical terminology. If a word was in the Stedman's Medical Dictionary, it was considered a technical word. If a technical word was not on the Dale-Chall list of 3000 familiar words, it was considered both unfamiliar and technical and labelled a difficult technical word. The number of difficult technical words per passage was calculated as a percentage of all of the words in the passage. The complete list of difficult technical words and the frequency of each, is reported in Appendix C.

Data Collection

In order to obtain the data on which to test the first hypothesis, which states that there is no relationship between the readability levels of the health education pamphlets and the percentage of difficult technical terminology contained in those pamphlets, the Dale-Chall readability formula was used to calculate Dale-Chall readability scores for each pamphlet in both the "Preventative" and "Restorative" groups. As well, calculation was made of the percentage of difficult technical words to all words from a passage.

The procedure used to obtain data for hypothesis two, which states that there is no difference between the readability levels of health education pamphlets in the presence versus absence in the pamphlets of difficult technical terminology, required removal of the difficult technical words from the passages in all of the pamphlets, according to the following criteria:

1) Words which are in the title are NOT changed, since it is assumed that the title words will have educational value in helping the reader to become familiar with the specific "Preventative" or "Restorative" action being described.

2) Disease names which are specifically associated with the pamphlet content, or the adjective which is derived from the disease name (eg. diabetes and diabetic mentioned in pamphlet about insulin) are NOT changed, for the same reason identified in the first criterion.

3) Difficult technical words which have an explanation in parenthesis or in a glossary are NOT changed. (Parentheses might not be within the 300 word passage, but have occurred somewhere in the pamphlet.)

4) Easy to understand words might have the difficult technical word in parentheses. These difficult technical words are NOT changed.

5) No proper names or titles are changed - eg. Committee on Diet and Cardiovascular Disease, or Canadian Cancer Society.

6) If removal of a difficult technical word in a sentence does not diminish the meaning of the sentence, it has NOT been replaced by a synonymous word, eg. 'elicit different heart rate responses' changed to 'elicit different heart rates'.

7) Difficult technical words which do not have a single word synonym, but where the concept can be explained, are replaced by as many words as necessary to describe the concept.

8) Difficult technical words which, if replaced, required grammatically awkward and lengthy explanations, are NOT changed, but are explained once parenthetically, and left unaltered for future occurrences. (With reference to this criterion, the words which were treated in this way were: infertility; cancer; ovulation; pneumonia; tumour; caloriel; and pressure.)

9) Words which are unfamiliar according to the Dale-Chall list of 3000 familiar words, but are not identified as difficult technical words, are NOT changed.

Furthermore, each difficult technical word which was removed was replaced by a synonymous word (or words) from the Dale-Chall list of 3000 familiar words.

However, it became apparent that many of the difficult technical words expressed concepts for which there existed no synonym on the Dale-Chall list of 3000 familiar words, and that it was often necessary to use several words to describe the concept. This amounted to replacement using phrases of synonymous meaning rather than word for word replacement. Sometimes the approach used simplified the expression, as for example changing "air taken into the lungs" to "the air we breathe", when in fact, "lungs" was not on the list, but "breathe" was.

In order to ensure that the revised passage still conveyed the meaning of the original, two nurse "experts" were requested to read the before and after substitution versions of the passages containing difficult technical terminology, and to judge the consistency of meaning between post- and pre-substitution versions. The judges were selected on the basis of one having a particular interest in one or another aspect of the way in which health education materials are used in teaching the public about health, and the other as someone having direct and regular contact with the users of educational materials, both of whom, it was assumed, could be expected to pay particular attention to the meaning of the message conveyed in the pamphlets. One of the nurses who agreed to act as a judge is a member of the Faculty of Nursing, University of Alberta, and the other nurse judge is a supervisior at one of the regional health centres of the City of Edmonton, Local Board of Health Department. Agreement of the judges was sought on the basis of consensus as to whether or not the revisions made to the passages conveyed the same meaning as the original. The judges were asked to make independent judgements and to judge specifically for each substitution, whether each revised passage: 1) conveyed the same meaning as the original, 2) failed to convey the same meaning as the original, or if they, as judges, were 3) unable to judge whether this revised passage conveyed the original meaning or not. And finally they were asked to indicate whether or not the meaning of the entire sample passage had been retained. They were given a copy of the Dale-Chall list of 3000 familiar words, with a request to suggest any replacement words which they thought more accurately conveyed the original meaning. The letter and complete instructions for each judge are to be found in Appendix D.

A second Dale-Chall readability score was calculated on each of the sample passages, after substitution of the difficult technical terminology, by word(s) which are on the Dale-Chall list of 3000 familiar words. The "Preventative" and "Restorative" groups were judged separately.

The procedure for obtaining data in order to test hypothesis three, sub-hypothesis a) which states that there is no relationship between the readability levels of health education pamphlets and the interpamphlet recurrence of difficult technical words, as measured by the occurrence in four or more pamphlets of the same difficult technical word required identifying the pamphlets yielding Dale-Chall readability scores at 6.9 or lower, and those yielding Dale-Chall readability scores at 7.0 or higher. (This division point was chosen because a Dale-Chall readability score of 6.9 or lower converts to a readability level of grade 8 or lower, and those with a score of 7.0 or higher converts to a readability level of higher than grade 8.) In effect this cut-off separates material comprehensible to the average reader from that which is not. The "Preventative" and "Restorative" groups were judged separately.

A frequency count was made of all difficult technical words recurring in four or more pamphlets, yielding Dale-Chall readability scores of 6.9 or lower, and the number recurring in pamphlets yielding Dale-Chall readability scores of 7.0 or higher. Non-recurrent difficult technical terminology was similarly counted, and grouped according to whether the pamphlets had Dale-Chall readability scores of 6,9 or lower and 7.0 or higher.

The procedure for obtaining data in order to test hypothesis three sub-hypothesis b) which states that there is no difference between the readability levels of health education pamphlets, and the intrapamphlet recurrence of difficult technical words, as measured by the occurrence four or more times per pamphlet of the same difficult technical word, a frequency count was made of all difficult technical terminology which recurred four or more times in sample passages which have a Dale-Chall readability score of 6.9 or lower, and the number recurring in pamphlets which have a Dale-Chall readability score of 7.0 or higher. Non-recurrent difficult technical terminology was similarly counted and grouped according to whether the pamphlets had Dale-Chall readability scores of 6.9 or lower, and 7.0 or higher.

CHAPTER III

THE DATA AND THEIR TREATMENT

It will be recalled that the statistical hypotheses for this study were:

1) Ho: There is no relationship, between the readability levels of health education pamphlets, and the percentage of difficult technical terminology contained in the pamphlets, under Pearson Prouct Moment Correlation analysis ($p < .05$).

2) Ho: There is no difference between the readability levels of health education pamphlets, in the presence versus absence in the pamphlets, of difficult technical terminology, under analysis of variance for repeat measures ($p < .05$).

3a) Ho: There is no relationship between the readability levels of health education pamphlets, and the interpamphlet recurrence of difficult technical words, as measured by the occurrence in four or more pamphlets, of the same difficult technical word, under Chi-square test of significance for independent samples ($p < .05$).

3b) Ho: There is no relationship between the readability levels of health education pamphlets, and the intrapamphlet recurrence of difficult technical words, as measured by the occurrence four or more times per pamphlet, of the same difficult technical word, under Chi-square test of significance for independent samples ($p < .05$).

The data for the testing of the hypotheses was generated by calculating the readability scores of the health education pamphlets using the Dale-Chall readability formula; identifying the difficult technical terminology as words listed and defined in The Stedman's Medical Dictionary, but not on the Dale-Chall list of 3000 familiar words; replacing the difficult technical terminology (according to criteria listed on page 55) with synonymous words which were on the Dale-Chall list of 3000 familiar words; and recalculating the Dale-Chall readability scores on the revised passages.

The Data: Readability Scores and Difficult Technical Terminology

The Dale-Chall readability scores in the 25 "Preventative" pamphlets ranged from 6.1 to 10.5 (grade 7-8 to college graduate level), with a mode of 6.5/6.9. (There was seldom more than one Dale-Chall score at any specific decimal place, therefore modes were determined on Dale-Chall scores grouped in increments of 0.5.) The mean Dale-Chall readability score was 7.8 (SD 1.12). Six of the 25 pamphlets (24%) had Dale-Chall readability scores of 7.0 to 7.9 (grade 9-10), 11 of the 25 (44%) had a readability score of 8.0 (grade 11-12) or higher, and only 8 of the 25 pamphlets (32%) had a Dale-Chall readability score of 6.9 (grade 8) or lower.

The mean readability levels of the specific subject matter groupings, show that the "Preventative" group had eight pamphlets with a Dale-Chall score of 6.9 (grade 8) or lower, and these were distributed across five of the six subject matter groupings. 'Parenting' had four pamphlets at Dale-Chall 6.9 (grade 8) or lower. The only subject in the "Preventative" group which did not have any pamphlets at Dale-Chall 6.9 (grade 8) or lower was 'Family Planning, Pre-natal and

Sexuality'. The mean Dale-Chall readability scores within each subject matter heading ranged from a low of 7.1 (grade 9-10) in the "Parenting" pamphlets, to a high of 8.9 (grade 11-12) in the "Family Planning, Pre-natal and Sexuality" pamphlets.

The unfamiliar words in the "Preventative" pamphlets had a total number of 1564 occurrences ranging from a low of 10.7% in a "Parenting" pamphlet to a high of 36.6% in a "Family Planning, Sexuality and Pre-natal" pamphlet. The mean occurrence of unfamiliar words was 21.6% (SD 6.52). Of the 1564 unfamiliar words, 696 (44.5%) were difficult technical words.

The percentage of difficult technical terminology in the "Preventative" group ranged from 1.3% in a "Parenting" pamphlet, to 17.5% in a "Family Planning, Pre-natal and Sexuality" pamphlet, with a mode of 13.0/13.9%. (As with the modal Dale-Chall readability scores, the percentages of difficult technical words were grouped in increments of one percentage point.) The mean occurrence of difficult technical words was 9.4% (SD 5.28).

The average sentence length ranged from a low of 10.7 to a high of 20.9 words per sentence, with a bi-modal distribution of 14.0/14.9 and 15.0/15.9 and a mean of 14.5 (SD 2.38). The Dale-Chall readability scores, percentage of unfamiliar words, percentage of difficult technical words and average number of words per sentence are reported in Table 3, page 63.

Of the difficult technical words which occurred one or more times for a total of 696 occurrences in the "Preventative" pamphlets, 570 recurrences were in fewer than four pamphlets, and of these, 89 recurrences were at a Dale-Chall readabilty score of 6.9 or lower, and 481 were at 7.0 or higher. One hundred twenty-six difficult technical

TABLE 3

Dale-Chall Readability Scores (D/C), Percent Per Passage of Unfamiliar Words (%UFW) and Difficult Technical Words (DTT); Mean Sentence Length (S/L) and Grade Level Equivalents of Preventative Health Education Pamphlets

Preventative (n=25)

Pam. I.D.	D/C Score	%UFW	%DTT	Mean S/L	Grade Level	Mean D/C Score	Mean % DTT
Family Planning, Sexuality, Pre-natal (n=4)							
PFP1	8.1	23.3	13.0	15.8	11-12	8.9	15.0
PFP7	8.6	27.1	15.8	13.9	11-12	SD 1.07	SD 2.04
PFP11	8.5	26.2	17.5	14.6	11-12		
PFP13	10.5	36.6	13.7	20.9	coll. gr.		
Fitness (n=3)							
PF27	9.2	30.3	17.2	15.6	college	7.9	10.4
PF40	7.5	20.5	12.5	12.4	9-10	SD 1.19	SD 8.00
PF44	6.9	17.2	1.6	11.9	7-8		
Mental Health (n=2)							
PMH48	6.7	15.7	4.0	11.1	7-8	7.6	6.0
PMH57	8.5	26.2	8.0	14.3	11-12	SD 1.27	SD 2.82
Nutrition (n=3)							
PN72	8.7	26.9	13.5	16.5	11-12	7.5	8.3
PN80	7.1	18.2	3.4	12.4	9-10	SD 1.02	SD 5.05
PN89	6.8	16.4	8.0	11.5	7-8		
Parenting (n=6)							
PP93	6.0	10.7	1.3	14.2	7-8	7.1	6.4
PP95	7.1	17.4	9.7	15.2	9-10	SD 1.27	SD 6.10
PN104	6.9	17.1	3.0	10.7	7-8		
PP105	6.7	15.5	2.4	12.9	7-8		
PP107	6.1	11.5	4.7	12.9	7-8		
PP120	9.5	31.5	17.3	17.4	college		
Smoking, Alcohol and Drug Abuse (n=7)							
PS128	9.1	29.8	15.2	15.2	college	7.9	9.8
PS133	8.1	22.4	9.6	17.8	11-12	SD 0.74	SD 3.36
PS141	7.3	18.9	7.1	14.1	9-10		
PS144	7.8	20.8	12.1	17.5	9-10		
PS160	7.4	18.5	11.5	13.4	9-10		
PS162	8.4	25.3	6.8	14.7	11-12		
PS176	6.9	16.0	6.0	15.8	7-8		
MEAN	7.8	21.6	9.4	14.5			
SD	1.12	6.52	5.28	2.38			
MODE	6.5/6.9	17.0/17.9 18.0/18.9 26.0/26.9	13.0/13.9	14.0/14.9 15.0/15.9			
RANGE	6.1-10.5	10.7-36.6	1.3-17.5	10.7-20.9			

words recurred in four or more pamphlets, and these were split with five occurrences at a Dale-Chall readability score of 6.9 or lower, and 121 at 7.0 or higher.

Five hundred forty seven of the 696 total occurrences of difficult technical words were fewer than four times within a pamphlet and these were split with 71 occurrences at a Dale-Chall readability score of 6.9 or lower, and 476 at 7.0 or higher. Of the 149 difficult technical word occurrences four or more times within a pamphlet, 23 words recurred at a Dale-Chall readability score of 6.9 or lower, and 126 were at 7.0 or higher.

The Dale-Chall readability scores in the "Restorative" group of pamphlets exhibited a similar range to those in the "Preventative" group, with scores ranging from 6.4 to 10.5 (grade 7-8 to college graduate level), and a mode of 7.0/7.4. This group had a higher mean Dale-Chall readability score however, at 8.3 (SD 1.03). Eight of the 25 "Restorative" pamphlets (32%) had a Dale-Chall readability score of 7.0 to 7.9 (grade 9-10), 16 of the 25 (64%) had readability scores of 8.0 (grade 11-12) or higher, and only one pamphlet (4%) had a Dale-Chall readability score of 6.9 (grade 8) or lower.

The mean Dale-Chall readability score of the specific subject matter groupings show that the "Restorative" group had only one pamphlet with a Dale-Chall readability score of 6.9 (grade 8) or lower. That one pamphlet was from the 'Respiratory' sub-category. The mean Dale-Chall readability scores within each subject matter heading ranged from a low of 7.6 (grade 9-10) in the 'Respiratory' group of pamphlets, to a high in the 'Cancer' pamphlets of mean Dale-Chall score of 8.8 (grade 11-12).

The unfamiliar words in the "Restorative" pamphlets occurred a total of 1748 times, ranging from a low of 12.3% in a "Respiratory" pamphlet to a high of 37.6% in an "Aging" pamphlet. The mean occurrence of unfamiliar words was 24.3% (SD 6.48). Of the 1748 unfamiliar words, 947 (54.2%) were difficult technical words. The percentage of difficult technical terminology in the "Restorative" group ranged from 6.9% in an "Aging" pamphlet, to 20.6% in a "Cancer" pamphlet, with a mode of 15.0/15.9%, and a mean occurrence of 12.7% (SD 4.25).

The average sentence length ranged from a low of 12.9 to a high of 23.7 words per sentence, with a mode of 17.0/17.9 and a mean of 16.8 (SD 2.56). The Dale-Chall readability scores, percentage of unfamiliar words, percentage of difficult technical words and average number of words per sentence are reported in Table 4, page 66.

Of the difficult technical words which occurred one or more times for a total of 946 occurrences in the "Restorative" pamphlets, there were 681 recurrences in fewer than four pamphlets, and of these, 23 occurrences were at a Dale-Chall readability score of 6.9 or lower, and 658 were at 7.0 or higher. Two hundred sixty-five difficult technical words recurred in four or more pamphlets. There was only one pamphlet with a Dale-Chall readability score of 6.9 or lower, and there were no occurrences of difficult technical words in this group. All 265 occurrences were at Dale-Chall 7.0 or higher.

Seven hundred thirteen of the 946 occurrences of difficult technical words happened fewer than four times within a pamphlet, and these were split with 16 occurrences at a Dale-Chall readability score of 6.9 or lower, and 697 at 7.0 or higher. Of the total occurrences of 233 difficult technical words which recurred four or more times within a pamphlet, 7 words recurred at a Dale-Chall readability score of 6.9 or lower, and 226 were at 7.0 or higher.

TABLE 4

Dale-Chall Readability Scores (D/C), Percent Per Passage of Unfamiliar Words (%UFW) and Difficult Technical Words (%DTT); Mean Sentence Length (S/L) and Equivalent Grade Levels of Restorative Health Education Pamphlets

Restorative (n=25)

Pam. I.D.	D/C Score	%UFW	%DTT	Mean S/L	Grade Level	Mean D/C Score	Mean % DTT
Aging (n=3)							
RA5	10.5	37.6	19.9	17.9	coll. gr	8.6	11.8
RA10	7.3	17.6	8.6	18.4	9-10	SD 1.66	SD 7.06
RA13	8.1	22.6	6.9	17.2	11-12		
Cancer (n=3)							
RC16	7.4	17.8	9.6	19.5	9-10	8.8	15.0
RC28	9.4	30.8	14.7	18.7	college	SD 1.18	SD 5.50
RC32	9.5	31.5	20.6	17.9	college		
Cardiovascular (n=7)							
RCV33	8.3	24.0	13.3	17.1	11-12	8.1	13.3
RCV38	8.8	27.6	17.6	15.6	11-12	SD 0.80	SD 3.92
RCV39	7.6	20.7	9.5	13.4	9-10		
RCV43	8.9	25.7	14.6	23.7	11-12		
RCV45	9.0	28.6	18.8	17.9	college		
RCV47	7.3	17.1	10.8	17.5	9-10		
RCV49	7.1	16.8	8.7	15.7	9-10		
Communicable Diseases (n=2)							
RCD57	8.0	21.7	7.2	18.1	11-12	8.6	11.3
RCD72	9.1	30.2	15.4	13.5	college	SD 0.77	SD 5.79
Diabetes (n=4)							
RD86	7.0	16.4	8.5	16.1	9-10	8.5	12.3
RD96	9.9	32.9	15.9	20.6	college	SD 1.19	SD 3.78
RD97	8.4	25.0	9.5	15.6	11-12		
RD102	8.8	26.8	15.1	18.9	11-12		
Mental Health (n=3)							
RMH107	7.0	16.9	7.1	13.4	9-10	8.3	12.5
RMH110	9.3	31.3	15.5	13.5	college	SD 1.19	SD 4.68
RMH117	8.7	27.2	14.9	14.7	11-12		
Respiratory (n=3)							
RR141	9.1	29.6	15.5	15.3	college	7.6	11.4
RR149	7.3	19.1	11.1	12.9	9-10	SD 1.37	SD 3.95
RR154	6.4	12.3	7.6	15.8	7-8		
MEAN	8.3	24.3	12.7	16.8			
SD	1.03	6.48	4.25	2.56			
MODE	7.0/7.4	16.0/16.9 17.0/17.9	15.0/15.9	17.0/17.9			
RANGE	6.4-10.5	12.3-37.6	6.9-20.6	12.9-23.7			

In the 50 pamphlets, 532 difficult technical words occurred one or more times for a total of 1642 occurrences. The most frequent occurrence across all pamphlets was the word 'problem', which was found 36 times in a total of 20 pamphlets. The next most frequent word was 'cancer', occurring 27 times in five pamphlets. It is noteworthy that although the word 'cancer' met the criterion of occurring in four or more pamphlets, 14 of those 27 occurrences were in one pamphlet. The third most frequent word was 'disease', with 24 occurrences in 15 pamphlets, and the word 'vein' was again notable - occurring fourth most frequently at 24 times, but with 20 of those appearances in one pamphlet.

The words which occurred frequently within any one pamphlet were generally not the same words as those occurring in four or more pamphlets. For example, the word 'problem' with its 36 occurrences, had a maximum number of appearances of three in any one pamphlet. The word 'physical' occured 18 times, but never more than twice in any one pamphlet. By contrast, the word 'suicide' occured 14 times - all in the same pamphlet, and the word 'emphysema' was found 13 times - all in the same pamphlet.

Four hundred and thirty-one, or 81% of the 532 difficult technical words were polysyllabic (have three or more syllables). Only 40 of the difficult technical words had one syllable, and 61 of them had two syllables.

Results

Hypothesis One

In testing hypothesis one, which states that there is no relationship between the readability levels of health education pamphlets and the percentage of difficult technical words in the pamphlets, it was anticipated that a Pearson Product Moment Correlation would be applied to the data. This test however, is appropriate only when the data exhibit a linear relationship. In order to ascertain whether or not linearity existed, a scattergram was developed from the data. Inspection revealed that in both the "Preventative" and "Restorative" groups, a straight line relationship existed between the Dale-Chall readability scores and the percentage of difficult technical words, lending itself to Pearson Product Moment Correlation analysis. The scattergram of the "Preventative" and of the "Restorative" data is presented in Figure 3, page 69.

For the "Preventative" group of pamphlets, under analysis by Pearson Product Moment Correlation ($p < .05$), a correlation of .79 was obtained between the Dale-Chall readability scores and the percentage of difficult technical terminology in the sample passages. Since the critical value for r (one tail test), df 23, and level of significance of .05 is .33, this result indicated a statistically significant positive relationship to hold between the readability levels of the "Preventative" pamphlets and the number of difficult technical words in the pamphlets, at the 95% confidence level and considerably beyond. These results are reported in Table 5, page 70.

Similarly, for the "Restorative" pamphlets, under Pearson Product Moment Correlation ($p < .05$), a correlation of $r=.85$ held between the Dale-Chall readability scores and the percentage of difficult technical terminology in the sample passages. Since the critical value for r (one tail test), df 23, and level of significance of .05 is .33, this result indicated a statistically significant positive

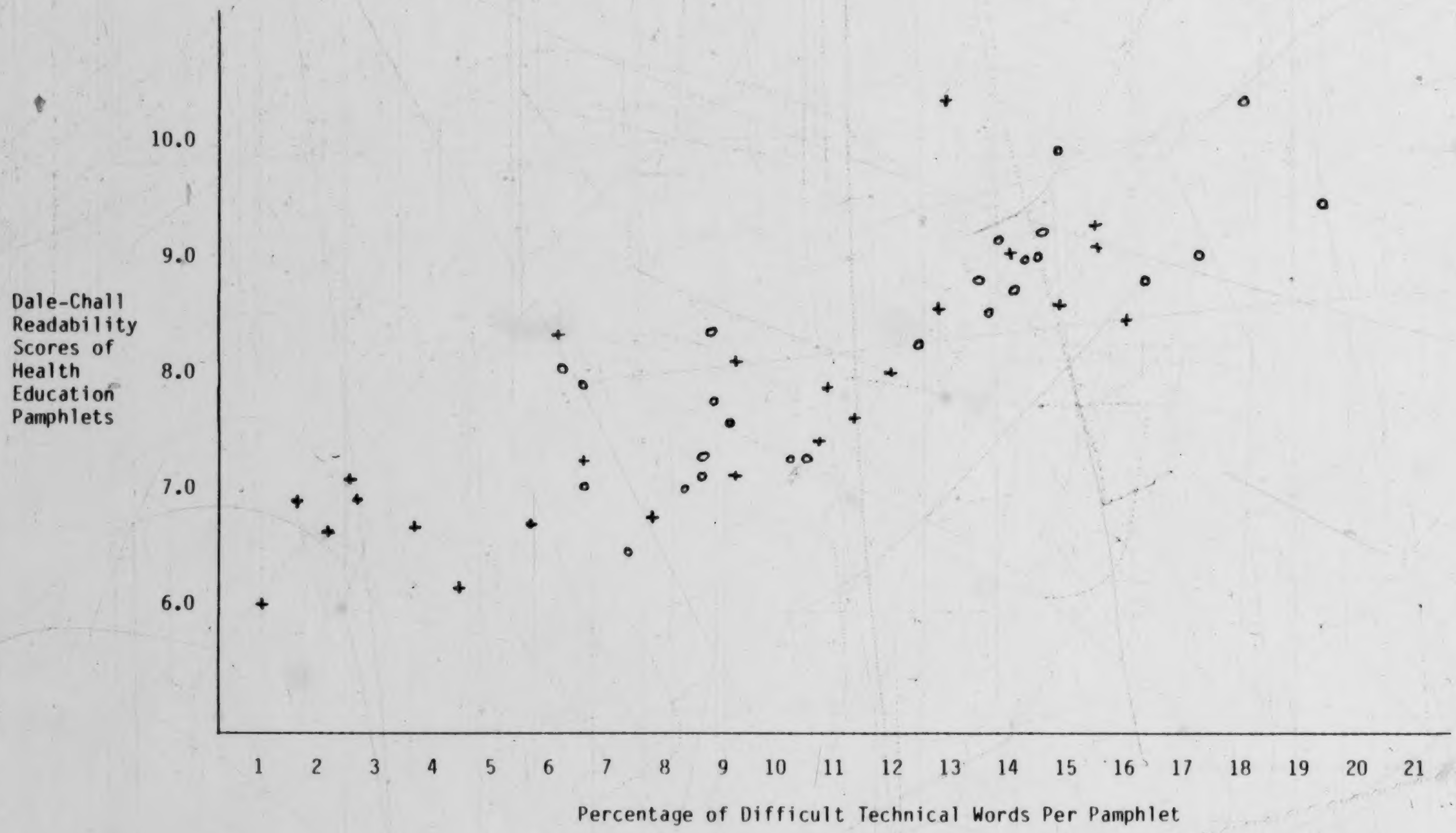

Figure 3: Scattergram of the Relationship Between Dale-Chall Readability Scores and the Percentage of Difficult Technical Words in Preventative (+) and Restorative (o) Health Education Pamphlets

relationship to hold between the readability levels of the "Restorative" pamphlets and the number of difficult technical words in the pamphlets, at the 95% confidence level and beyond. Based on the results of data analysis for the first hypothesis, it is possible to reject the null hypothesis and accept the alternate hypothesis. Thus it can be said that in both the "Preventative" and "Restorative" health education pamphlets, there is a direct, high positive relationship between the readability levels of health education pamphlets, and the percentage of difficult technical terminology contained in the pamphlets. These results also are reported in Table 5, page 70.

TABLE 5

Pearson Product Moment Correlation Between Dale-Chall Readability Scores (D/C) and Percentage of Difficult Technical Terminology (% DTT) in Preventative and Restorative Health

Preventative (n=25)	r	d.f.	r	sign.
Pamphlets D/C with % DTT	.79	23	.33	*.00000
Restorative (n=25)				
Pamphlets D/C with % DTT	.85	23	.33	*.00000

*Significant at the .05 level and beyond.

Before testing could be conducted on hypothesis two, which states that there is no difference between the readability levels of health education pamphlets in the presence versus absence in the pamphlets of difficult technical terminology, it was necessary to incorporate the findings of the two (nurse) judges, as to whether or not the revised passages with fewer difficult technical words, conveyed the same meaning as the original material. In keeping with the criteria for changing difficult technical terminology, as described on page 55, some of the difficult technical terminology had been left unchanged, with the result that, of the 696 difficult technical words in the "Preventative" passages, 489 or 70.3% were replaced. Similarly, in the "Restorative" group of pamphlets, of the 923 difficult technical words, 573 or 62.1% were replaced. In total 1412 (85.9%) of the 1642 difficult technical words were changed. The judges agreed with all but 70 out of the 1412 changes. Of the 70, they concurred that on 13 of the changes, the revision failed to convey the original meaning. Of the 57 changes where there was initial disagreement between the judges as to whether or not the original meaning was retained, one judge disagreed with 26 of the changes, and the other judge disagreed with 31 of the changes. The investigator met with the judges, who discussed the 57 changes on which they were in disagreement with each other regarding the consistency of meaning from original to revised passages. As a result of the discussion, the two judges agreed that seven of the revisions had not changed the original meaning of the passages, and 50 needed further revision. The further revisions were made on these 50 pamphlets, and each judge independently agreed that the meaning of the originals were conveyed by the final revisions. It was concluded by the investigator, that on all of the 1412 changes of difficult technical terminology, the revised passages constitute data adequate for testing hypothesis two. The mean Dale-Chall score of the original material was compared with the mean Dale-Chall score of the revised material in which the difficult technical terminology had been replaced with less difficult technical terminology. In keeping with the criteria for changing difficult technical terminology, described on page 55, some of the difficult technical words were left unchanged.

Since replacement of difficult technical terminology had in many instances necessitated using extra words to convey the correct meaning, the mean number of words per sentence in the revised passages was, in those instances, increased. In the "Preventative" group of pamphlets, the original passage sentence length was 14.5 words per sentence, and after revision, this increased to 15.6 words per sentence. In the original "Restorative" pamphlets, the original passage sentence length was 16.8 words per sentence, and this was increased to 18.0 words per sentence after revision. To test whether the revision of the passages had increased the mean number of words per sentence to a statistically significant degree, t-test analysis was applied to the mean difference of sentence length of the original and revised passages. The obtained t value for the "Preventative" pamphlets was 1.33, and for the "Restorative" pamphlets was 1.58. The critical value of t (one tail test), df 48, and a level of significance of .05, is 1.68, leading to acceptance that the increase in average sentence length between the original and revised passages in both the "Preventative" and "Restorative" pamphlets was not significant, and therefore did not contribute to a change in readability level. These results are reported in Table 6, page 73.

TABLE 6

T-test Comparison of the Mean Sentence Length (S/L) Between the Original and Revised forms of the Preventative and Restorative Health Education Pamphlets

Preventative Pamphlets (n=25)	Mean S/L	SD	df	t	t_{95}
Original	14.5	2.38	48	1.33	1.68
Revised	15.6	3.06			

Non-significant at the .05 level.

Restorative Pamphlets (n=25)	Mean S/L	SD	df	t	t_{95}
Original	16.8	2.56	48	1.58	1.68
Revised	18.0	2.83			

Non-significant at the .05 level.

The original and revised figures for: Dale-Chall readability scores; percentage of unfamiliar words; percentage of difficult technical words; and mean number of words per sentence, are reported for the "Preventative" and Restorative" groups of pamphlets in Table 7, page 74, and Table 8, page 75, respectively.

For the sake of stringency in testing for the difference in the Dale-Chall scores, it was decided to control statistically for the effect on the formula score, of altered mean sentence length. This was undertaken using analysis of variance for repeat measures to compare the original and revised means. This analysis takes into account the number of words per sentence in each of the sets of Dale-Chall scores, and yields a calculation of the mean change in Dale-Chall scores between first and second mean calculation, in effect holding sentence length (statistically) constant.

TABLE 7

Dale-Chall Scores (D/C-O) (D/C-R), Percent Per Passage of Unfamiliar Words (% UFW) and Percentage of Difficult Technical Words (% DTT), and Mean Sentence Length (S/L) of Original and Revised Preventative Health Education Pamphlets

PREVENTATIVE PAMPHLETS (n=25)

PAM. I.D.	D/C-O	% UFW	% DTT	MEAN S/L	D/C-R	% UFW	% DTT	MEAN S/L
Family Planning, Sexuality, Pre-natal (n=4)								
PFP1	8.1	23.3	13.0	15.8	6.7	13.6	4.4	17.8
PFP7	8.6	27.1	15.8	13.9	6.3	11.6	2.4	16.0
PFP11	8.5	26.2	17.5	14.6	6.5	12.6	5.4	17.5
PFP13	10.5	36.6	13.7	20.9	8.4	22.2	3.1	25.0
Fitness (n=3)								
PF27	9.2	30.3	17.2	15.6	6.8	14.9	2.8	17.0
PF40	7.5	20.5	12.5	12.4	5.8	8.7	1.2	13.4
PF44	6.9	17.2	1.6	11.9	6.7	16.3	0	12.0
Mental Health (n=2)								
PMH48	6.7	15.7	4.0	11.1	6.0	11.1	0	11.7
PMH57	8.5	26.2	8.0	14.3	7.8	21.8	4.4	15.0
Nutrition (n=3)								
PN72	8.7	26.9	13.5	16.5	7.5	18.9	5.9	17.0
PN80	7.1	18.2	3.4	12.4	6.6	14.9	.7	12.9
PN89	6.8	16.4	8.0	11.5	6.0	11.4	3.5	12.2
Parenting (n=6)								
PP93	6.0	10.7	1.3	14.2	5.8	9.3	0	14.3
PP95	7.1	17.4	9.7	15.2	5.8	8.9	1.6	16.2
PN104	6.9	17.1	3.0	10.7	6.6	15.2	1.6	11.0
PN105	6.7	15.5	2.4	12.9	6.3	13.0	0	13.0
PN107	6.1	11.5	4.7	12.9	5.4	7.2	0	13.4
PP120	9.5	31.5	17.3	17.4	7.4	17.6	4.6	19.0
Smoking, Alcohol and Drug Abuse (n=7)								
PS128	9.1	29.0	15.2	15.2	7.6	19.9	6.4	16.4
PS133	8.1	22.4	9.6	17.0	6.7	13.5	1.5	18.2
PS141	7.3	18.9	7.1	14.1	6.2	11.5	.3	15.0
PS144	7.0	20.0	12.1	17.5	6.1	9.0	1.6	18.7
PS160	7.4	18.5	11.5	13.4	5.5	7.3	.9	14.9
PS162	8.4	25.3	6.0	16.7	7.6	20.2	3.0	19.0
PS176	6.9	16.0	6.0	15.0	6.1	10.4	1.0	16.7
MEAN	7.0	21.6	9.4	14.5	6.6	13.6	2.3	15.6
SD	1.12	6.52	5.28	2.38	0.75	4.61	2.00	3.06
MODE	8.5/6.9		13.0/13.9					
RANGE	6.1-10.5		1.3-17.5					

TABLE 8

Dale-Chall Scores (D/C-O) (D/C-R), Percent Per Passage of Unfamiliar Words (% UFW) and Difficult Technical Words (% DTT), and Mean Sentence Length (S/L) of Original and Revised Restorative Health Education Pamphlets

RESTORATIVE PAMPHLETS (n=25)

PAM. I.D.	D/C-O	% UFW	% DTT	MEAN S/L	D/C-R	% UFW	% DTT	MEAN S/L
Aging (n=3)								
RA5	10.5	37.6	19.9	17.9	8.3	23.0	8.3	21.8
RA10	7.3	17.6	8.6	18.4	6.0	8.6	0	19.1
RA13	8.1	22.6	6.9	17.2	7.0	16.0	.7	17.7
Cancer (n=3)								
RC16	7.4	17.8	9.6	19.5	6.2	9.4	1.6	20.5
RC28	9.4	30.8	14.7	18.7	7.4	17.5	3.3	21.1
RC32	9.5	31.5	20.6	17.9	7.8	20.1	10.1	19.3
Cardiovascular (n=7)								
RCV33	8.3	24.0	13.3	17.1	6.7	13.5	3.6	18.5
RCV38	8.8	27.6	17.6	15.6	6.3	11.2	2.7	18.3
RCV39	7.6	20.7	9.5	13.4	6.4	12.8	2.5	14.5
RCV43	8.9	25.7	14.6	23.7	7.8	18.3	7.9	25.2
RCV45	9.0	28.6	18.8	17.9	7.7	19.7	10.3	18.8
RCV47	7.3	17.1	10.8	17.5	6.4	11.6	5.5	18.2
RCV49	7.1	16.8	8.7	15.7	5.9	8.8	1.3	16.7
Communicable Diseases (n=2)								
RCD57	8.0	21.7	7.2	18.1	7.2	16.6	2.1	18.1
RCD72	9.1	30.2	15.4	13.5	6.8	15.0	2.1	15.5
Diabetes (n=4)								
RD86	7.0	16.4	8.5	16.1	6.1	10.4	2.8	16.7
RD96	9.9	32.9	15.9	20.6	8.2	21.7	6.3	22.7
RD97	8.4	25.0	9.5	15.6	7.6	20.1	5.2	16.3
RD102	8.8	26.8	15.1	18.9	7.8	20.1	9.1	19.9
Mental Health (n=3)								
RMH107	7.0	16.0	7.1	13.4	6.1	11.5	1.9	13.6
RMH110	9.3	31.3	15.5	13.5	7.4	18.9	4.8	15.2
RMH117	8.7	27.2	14.9	14.7	7.1	16.7	5.4	16.0
Respiratory (n=3)								
RR141	9.1	29.6	15.5	15.3	7.0	16.0	3.1	16.8
RR149	7.3	19.1	11.1	13.0	6.3	12.9	5.1	13.6
RR150	6.6	12.3	7.6	15.8	5.8	8.6	4.0	15.9
MEAN	8.3	24.3	12.7	16.8	6.9	15.2	4.6	18.0
SD	1.05	6.60	4.25	2.56	0.76	4.42	2.91	2.83
MODE	7.0/7.3		15.5/15.9					
RANGE	6.6-10.5		6.9-20.6					

In testing for the amount of variance due to difficult technical terminology in the "Preventative" group, the obtained F value was 7.93. Testing for variance due to difficult technical terminology in the "Restorative" group yielded an F value of 10.062. Since the critical value of F (one tail test), 2.22 d.f., at a level of significance of .05 is 3.42, in both cases the mean drop in readability level was statistically significant at a confidence level of 95% and beyond. From these results, which are reported in Table 9, page 77, it is possible to reject the null hypothesis, and consequently to accept the alternate hypothesis, that for both the "Preventative" and "Restorative" groups of pamphlets, there is a decrease in the readability levels of health education pamphlets, following substitution of the difficult technical terminology contained in the pamphlets by synonymous technical terminology as found in the Dale-Chall list of 3000 familiar words, when controlling for change in sentence length due to replacement.

Hypothesis Three

The testing or hypothesis three sub-hypothesis a) which states that there is no reltionship between the readability levels of health education pamphlets nd the interpamphlet recurrence of difficult technical words, as measred by the occurrence in four or more pamphlets, of the same difficult technical word, was analyzed using Chi-square with an applied Yates correction. For the "Preventative" pamphlet analysis, the critical value for chi-square (one tail test), df 1, at a level of significance of .05 is 3.84. The obtained Chi-square value

TABLE 9

Analysis of Variance for Repeat Measures Between Mean Dale-Chall Readability Scores of Health Education Pamphlets in Original Form and After Revision, for Preventative and Restorative Samples

Preventative Pamphlets (n=25)	Mean D/C	S.D.	df	F	F 95	F 99
Original Pamphlets	7.8	1.12	2.22	*7.93	3.42	5.72
Revised Pamphlets	6.6	0.77				

*Significant at the .05 level and beyond.

Restorative Pamphlets (n=25)						
Original Pamphlets	8.3	1.05	2.22	*10.06	3.42	5.72
Revised Pamphlets	6.9	0.76				

*Significant at the .05 level and beyond.

was 11.98, and after application of Yates correction for small expected frequencies, Chi-square was 11.00. Both of these Chi-square values were statistically significant at the 95% confidence level and beyond, leading to rejection of the null hypothesis, and consequently acceptance of the alternate hypothesis. It can be said therefore, that there was a direct positive relationship of dependence between the readability levels of "Preventative" health education pamphlets, and the recurrence of difficult technical words, as determined by the recurrence in four or more pamphlets of difficult technical words. The results are reported in Table 10, page 78.

TABLE 10

Chi-square Test for Independence Between Dale-Chall Readability Scores of Preventative Health Education Pamphlets and the Inter-pamphlet Recurrence of Difficult Technical Words

Occurrence Diff. Tech. Words	Dale-Chall 6.9 or lower	Dale-Chall 7.0 or higher	Total
Fewer than 4 pamphlets	0=89 E=77.0	0=481 E=493.0	570
4 or more pamphlets	0=5 E=17.0	0=121 E=109.0	126
Total	94	602	696

Chi-square at level of significance .05, df 1, is 3.84.
Test value of Chi-square, df 1, is 11.98.
Test value of Chi-square after Yates correction, df 1, is 11.00, significant at .05 level and beyond.

Testing for hypothesis three sub-hypothesis b) which states that there is no relationship between the readability levels of health education pamphlets and the intrapamphlet recurrence of difficult technical words, as measured by the occurrence four or more times per pamphlet, of the same difficult technical words, was also subjected to Chi-square analysis. For the "Preventative" pamphlets, the critical value of chi-square (one tail test), df 1, and a level of significance is .05, is 3.84. The obtained chi-square value for the frequency of specific difficult technical words which occurred at least four times in any one pamphlet, in relation to the Dale-Chall score of the pamphlet was .604, indicating that the test results were not significant, and it was not possible to reject the null hypothesis.

TABLE 11

Chi-square Test for Independence Between Dale-Chall Readability Scores of Preventative Health Education Pamphlets and the Intra-pamphlet Recurrence of Difficult Technical Words

Occurrence Diff. Tech. Words	Dale-Chall 6.9 or lower	Dale-Chall 7.0 or higher	Total
Fewer than 4 times per pamphlet	0=71 E=73.9	0=476 E=473.1	547
4 or more times per pamphlet	0=23 E=20.1	0=126 E=128.9	149
Total	94	602	696

Chi-square at level of significance .05, df 1, is 3.84.
Test value of Chi-square is .604, df 1, non-significant at .05 level.

For the testing of hypothesis three, subhypothesis a) and the "Restorative" pamphlets, the critical value of Chi-square (one tail test), df 1, and a level of significance of .05 is 3.84. The obtained Chi-square value was 9.17 and after Yates correction for small expected frequencies, Chi-square was 7.83. Both of these values were statistically significant at the 95% confidence level and beyond leading to rejection of the null hypothesis, and consequently acceptance of the alternate hypothesis. Thus it can be stated that there was a direct positive relationship of dependence between the readability levels of restorative health education pamphlets, and the recurrence of difficult technical words, as determined by the recurrence in four or more pamphlets of difficult technical words. The results are reported in Table 12, page 80.

TABLE 12

Chi-square Test for Independence Between Dale-Chall Readability Scores of Restorative Health Education Pamphlets and the Inter-pamphlet Difficult Technical Words

Occurrence Diff. Tech. Words	Dale-Chall 6.9 or lower	Dale-Chall 7.0 or higher	Total
Fewer than 4 pamphlets	0=23 E=16.6	0=658 E=664.4	681
Four or more pamphlets	0=0 E=6.4	0=265 E=268.6	265
Total	23	923	946

Chi-square at level of significance .05, df 1, is 3.84.
Test value Chi-square df 1 is 9.17.
Test value of Chi-square, df 1, after Yates correction is 7.83, significant at .05 level and beyond.

For the "Restorative" pamphlets, hypothesis three sub-hypothesis b) which states that there is no relationship between the readability level of health education pamphlets and the intrapamphlet recurrence of difficult technical words, as measured by the occurrence four or more times per pamphlet, of the same difficult technical word, was also subjected to Chi-square analysis. The critical value of chi-square (one tail test), df 1, and a level of significance of .05, is 3.84. The obtained Chi-square value for the frequency of specific difficult technical words which occurred at least four times in any one pamphlet, in relation to the Dale-Chall score of the pamphlet was .427, indicating that the test results were not significant, and it was not possible to reject the null hypothesis. These results are reported in Table 13, page 81.

TABLE 13

Chi-square Test for Independence Between Dale-Chall Readability Scores of Restorative Health Education Pamphlets and the Intra-pamphlet Recurrence of Difficult Technical Words

Occurrence Diff. Tech. Words	Dale-Chall 6.9 or lower	Dale-Chall 7.0 or higher	Total
Fewer than 4 times per pamphlet	O=16 E=17.3	O=697 E=695.7	713
Four or more per pamphlet	O=7 E=5.7	O=226 E=227.3	233
Total	23	923	946

Chi-square at level of significance .05, df 1, is 3.84.
Test value of Chi-square, df 1, is .427, non-significant at .05 level.

CHAPTER IV

DISCUSSION OF THE RESULTS

The purpose of this study, it will be recalled, was to examine the contribution of difficult technical language to the readability of health education pamphlets-in-use and thereby add to the general body of knowledge concerning the comprehensibility, and therefore usefulness of pamphlets as a means of educating the public on health matters. The study was designed to add to the existing knowledge by:

- determining whether the readability levels of a sample of health education pamphlets in current use are comprehensible to the potential users of those pamphlets on the basis of their readability alone;
- determining whether the difficult technical terminology in the pamphlets bears a relationship to the readability levels of the pamphlets;
- determining whether or not the readability levels of the pamphlets could be lowered by replacing the difficult technical terminology in the pamphlets, with synonymous technical words which would be understood by the average reader;
- determining whether the readability levels of the health education pamphlets were, in part, a function of the recurrence of some difficult technical words within and/or across pamphlets.

In general, it was found that the readability levels of health education pamphlets are higher than grade 8 and, all else being equal, only nine out of 50 (18%) would be readable by the average person, defined as one with a grade 8 reading ability, 14 (28%) had a readability level of grade 9-10, and 27, or more than half of the pamphlets would be at a reading level requiring 11 to 12 years of education. The literature describing the readability levels of health education pamphlets is, as yet, limited. However results of the present study support the consistently reported finding that health education pamphlets are written at a level of difficulty which is beyond the reading ability of the average user of the pamphlets defined in this study as grade eight.

The present study results indicated that only 18% of the pamphlets had a readability level of grade 8 or lower, while 54% require a grade 11 or higher education in order to be understood, support the results of Spadero et al. (1980) who found, using the Flesch readability formula, that 20 (18%) of 111 pamphlets were readable at grade 8 or lower, and 54 (48.6%) were readable at grade 10 or higher. Results of other reported studies of a cross section of health education pamphlets are also supported by the present findings, as indicated by: Spadero's (1983) findings that with the SMOG formula, 5 of 55 (9%) pamphlets had a readability level of grade 8 or lower, and 34 (61.3%) were at a readability level of grade 10 or higher; Holcomb (1981) using the Flesch formula to show that 6 of 15 (40%) pamphlets were readable at grade 10 or higher; Doak and Doak (1980) who reported SMOG results of a mean readability level ofgrade 10 when measured on 100 pamphlets; and Freimuth (1979) who showed with the SMOG formula that every one of 20 pamphlets studied had a readability level of grade 11 or higher.

The other readability analyses of health education pamphlets (Dale and Hager, 1950; Thrush and Lanese, 1962; Ley, 1972; Kahn, 1978; Liquori, 1979; Vivian and Robertson, 1980; Leichter et al., 1981; Bakdash et al., 1983; Hopkinson, 1983) each concentrate on specific subject matter, which limits the comparison one can make with the present study. The nine studies show however, using the Dale-Chall, Fry, FOG, SMOG and Flesch formulae, that with only one exception, all have demonstrated pamphlet readability levels with between 37% and 65% of the material falling at a grade 11 or higher readability level. The only study which is an exception to this finding was that of Liquori (1979), where only one in four pamphlets was at a readability level of grade 11 or higher, but it is important to keep the extremely limited sample size (n=4) in perspective.

It is evident that there is a large measure of agreement between the readability levels of health education pamphlets, reported in the present study and those reported in other studies. The pamphlets are typically prepared at a readability level higher than grade 8, and are therefore at a reading level which would be too difficult for the average reader to understand. If a pamphlet can not be understood by a reader, then the pamphlet is of no use in teaching the reader about a condition.

The present study has concentrated on measurement of the vocabulary difficulty in the pamphlets, with the particular focus on difficult technical terminology. Despite the findings by Samora et al. (1969); Smeltzer, (1980), that words having their only meaning in the field of health, or having a specialized meaning when applied to the health field, are not generally understood by non-health care professionals, regardless of educational attainment, the evidence from the present study is that as high as 20% of all of the words in the pamphlets are technical words. This means that from the 50 pamphlets analyzed, as many as one out of every five of the words in the material which is supposed to be helping a user learn more about preventative or restorative health care, is not likely to be understood by average readers, thus severely limiting the educational potential of the pamphlets as a health education method.

Only two other readability studies of health education pamphlets have reported any vocabulary analyses (Thrush & Lanese, 1962; Leichter et al., 1981), and neither of these has sub-divided the unfamiliar words into technical versus non-technical terminology, nor reported specifically on the association between readability levels and difficult technical terminology. Although one can not therefore draw any comparisons with previous studies specifically about the difficult technical terminology in the pamphlets, the finding of the present study, that the unfamiliar words (technical and non-technical combined) ranged from 10.7% to 36.6% in the "Preventative" pamphlets and 12.3% to 37.6% in the "Restorative" pamphlets, was in agreement with the results of Leichter et al., who report unfamiliar words in the range of 12% to 31% in the eight pamphlets which they analyzed. It seems from this limited evidence that up to 1/3 of the words used in health education pamphlets typically are unfamiliar words. Any words, whether technical or non-technical, which are unfamiliar to a reader, will limit the comprehensibility of written material for that reader. It remains now to investigate the importance of specifically difficult technical terminology to the readability levels of the pamphlets, in order to affirm the results of the present study.

It was shown in this study that the "Preventative" and "Restorative" groups of pamphlets differed significantly with respect to the proportion of difficult technical terminology which they contain. None of the reported studies has made a similar division between preventative and restorative content, so there was no basis upon which to compare this specific finding. A conclusion from the present study however, was that pamphlets which describe the everyday health care behaviors of an individual do have proportionately fewer difficult technical words than do the pamphlets which describe a "treatment" action. Furthermore, it appeared from the results of the present study that the difficult technical terminology was used more frequently in some subject matter pamphlets than in others. Further study should be directed toward determining the extent of the relationship between specific subject matter of pamphlets and the occurrence of difficult technical terminology in them. If it were the case that certain subject matter groups typically contain difficult technical words, health educators could be cautioned to be particularly careful with regard to the terminology of such pamphlets.

The relationship revealed in the findings between readability levels and occurrence of difficult techical terminology, merits full discussion.

Hypothesis One

The testing of Hypothesis one, was undertaken to determine whether or not the Dale-Chall readability scores of health education pamphlets would increase as the number of difficult technical words increased. Support for this apparently common sense conclusion was demonstrated when the findings revealed a high positive relationship to obtain: a Pearson Product Moment Correlation of r=.85 held between the readability scores of the 'Restorative' pamphlets and the percentage of difficult technical terminology in those pamphlets, and one of r=.79 held for the readability scores of the 'Preventative' pamphlets. Although no other reported research has established the degree of association between the readability levels of the health education pamphlets and the difficult technical terminology contained in the pamphlets, it bears repeating that the results were found to be significant at the 5% level and beyond, providing evidence that there was a strong positive relationship between the Dale-Chall readability scores of health education pamphlets and the percentage of difficult technical terminology occurring in the pamphlets.

If words related to health are generally not understood by non-health care professionals, and if the pamphlets are to serve an educational purpose and be readable at the level of the average reader, the information must be presented using words which the average reader will understand. Obviously the more difficult technical words the pamphlets contain, the higher the readability levels will be, hence the less useful the pamphlets will be as a method of teaching users about how to manage their own health care.

It was only after all of the difficult technical words were identified in preparation for hypothesis testing that it was noted that most (81%) were polysyllabic (three or more syllables). There is no evidence with which to compare this finding of the remarkably high number of polysyllabic difficult technical words, but one could speculate that the difficulty which a reader might experience in understanding a technical word, is in part a function of the number of syllables in the word. Study of the relationship between the readability levels of health education pamphlets and technical word length should be conducted. Perhaps the length, and not the familiarity of the technical word, is the factor in the high readability levels of health education pamphlets.

Hypothesis Two

The testing of hypothesis two was undertaken to determine whether the readability levels of the pamphlets could be lowered when the difficult technical terminology in the pamphlets was replaced with more easily understood technical words, while retaining the meaning contained in the originals. Of the 1642 difficult technical words in the 50 pamphlets, 1412 (85.9%) were replaced, and this substitution using words from the Dale-Chall list of 3000 familiar words, significantly lowered the mean Dale-Chall readability scores at the 5% level and beyond. The only other health related study which reports changing difficult technical terminology and calculating a second readability level on the revised material was that of Pyrczak and Roth (1976). Unlike the present study however, this limited investigation was analysis of 'warnings' on medication labels. There are therefore, no findings of difficult technical words in health education pamphlets with which to compare the present study directly. It is apparent however, that the readability levels of health education pamphlets can be lowered to a significant extent just by keeping the number of difficult technical words down.

There are undoubtedly synonyms which could have been used in the present study which would have conveyed the meaning of the original material in a more concise way than occasionally occurred in the present study. Also having available a variety of synonyms for some of the difficult technical words would ease the task of the writer of materials who is wanting to write in a style which will retain the reader's interest. This study demonstrated the potential value of a list of difficult technical words and their synonyms which would help those writing materials to know which technical words to avoid and some alternate words which could be used to convey the same meaning.

One limitation to trying to change all of the difficult technical terminology in the pamphlets, lies in the fact that there are times when the writer of the material may choose to leave a difficult technical word in the material. As Dale and Hager (1950) note, the practice of using difficult technical terminology, and then explaining it has educational value. For example, a word such as diabetes which identifies a disease condition, or a word such as insulin which a reader should know in connection with the disease, might be left in the pamphlets. When such words were left unchanged in the present study, the readability scores remained higher than they would have been if all of the difficult technical terminology had been removed. For example, in the pamphlet entitled "Varicose Veins", the word 'vein(s)' occurred 20 times, and 'varicose' eight times. The original Dale-Chall readability score was 9.0 and a recalculated Dale-Chall score 7.7. If the revised materials had not contained those 28 occurrences of 'vein(s)' and 'varicose', the recalculated Dale-Chall readability score would have been 6.3, requiring, roughly speaking, a reading ability of grade 7.

One could argue that a reader who is overwhelmed by the presence in the pamphlets, of words which are hard to understand, may not persevere with the reading. However, if many difficult technical words can be excluded, the few which remain can be explained using terminology which the average reader can understand, thus enhancing the educational value of the material. One could further argue that the increased readability level of the material caused by the few remaining difficult technical words is a reasonable trade-off. In the present study two observations can be made about the use of difficult technical terminology which might have educational value.

Firstly, the explanation given of the difficult technical words, if present, was given for those words directly related to the pamphlet topic, while all other difficult technical words in the pamphlet are ignored. For example the pamphlet "If Your Child Has A Congenital Heart Defect" provided parenthetical explanation of 'stenosis' and 'ventricle', while words such as 'diagnosis' and 'surgery', although also difficult technical words, were unexplained. In instances such as these, it would appear that those who are preparing the materials are aware of the need for explanation of some of the technical words, but this awareness has been confined to a concern with words associated with the particular topic. It is important that persons preparing health education materials provide explanation of all of the difficult technical words in the pamphlets, if the pamphlets are to be useful as a teaching method for the average reader. Secondly, where a parenthetical explanation was used after a difficult technical word, the word in parentheses was often another health-related word which would not be understood. For example, the pamphlet "Food and Your Heart" used the word 'calorie' to explain the word 'energy'. Neither of these words is on the Dale-Chall list of 3000 familiar words, pinpointing these as difficult technical words. If one is to use explanatory words, they must be words which are easily understood, if the usefulness is to be enhanced.

A concept is an idea of a class of objects; a general notion or idea (Oxford, 1971). The problems associated with using a word to describe a complicated specialized concept was apparent during the data generation for the test of hypothesis two. Studies have shown (Boyle, 1970; Tring and Hayes-Allen, 1973) that many people are not aware of the location of the body organs, nor of the function of these organs. One can interpret this to mean that the individual who lacks this knowledge, has not developed a conceptual understanding as opposed to perceptual recognition of the 'workings of the human body'. Dale and Hager (1950) warned about words which require conceptual understanding when they expressed the need for writers of health education materials to find the most effective way of presenting complicated, specialized concepts which require the use of technical language. If one defines specific health concept words as identifying: a part of the body; a function or product of part of the body; or a dysfunction of part of the body, in the present study there are identified 85 (15.9%) of the 532 difficult technical words which are specific concept words - words such as 'contraception', 'sterility', 'infertility' and 'hereditary'. If the specific concept being described is unfamiliar to a reader, it is not an adequate procedure to use synonymous words for purposes of understanding of the concept. The concept itself will still not be understood and must itself be explained.

It will be recalled that 13 of the 25 'Preventative' pamphlets and 10 of the 25 'Restorative' pamphlets were lowered to a Dale-Chall score of 5.5 to 6.5. In some pamphlets, the readability levels remained high despite the removal of difficult technical terminology. For example, the original passages from the pamphlet "Travelling with Diabetes" had 25% of the passage words identified as unfamiliar. After removal of the difficult technical words, there were still 20% of the words which were unfamiliar. Examples of these words are 'circumstances', 'confidence', 'departure', and 'anticipate'. Since the t-test analysis demonstrated that the sentence lengths of the passages had not increased significantly, and the other variable measured by the formula is the percentage of unfamiliar words, it must be the remaining unfamiliar non-technical words in the passages which kept the readability, as measured, high. One can conclude therefore, that in order to enhance the educational benefit of the pamphlets, care should be taken to avoid, as much as possible, both technical and non-technical unfamiliar words.

Another example will illustrate how the non-technical unfamiliar words may be a major factor in the comprehensibility of the material. In the pamphlet "Frequently Asked Questions About Alzheimer's Disease", the phrase 'adverse drug reactions' was changed to 'the body acting in an adverse way to drugs'. The difficult technical word which was changed was 'reaction', while the word 'adverse' remained because it is not in the Stedman's Medical Dictionary. Since 'adverse' is an integral part of the meaning of the phrase, it seems likely that if a reader did not understand the original, the revised would also not be understood. Since the specific focus of the present study was on the difficult technical terminology, no attempt was made to change the unfamiliar non-technical words. However, it bears repeating that if a writer of the pamphlets wants to ensure that as much of the educational message as possible will be understood, most unfamiliar words, both technical and non-technical, should be avoided.

During revision of the passages, one pamphlet "AIDS" provided evidence of how quickly the specialized language of health is expanding. The acronym name AIDS occurred 11 times within the passage, but the condition has been diagnosed so recently as a medical syndrome that it is not described in the latest version of the Stedman's Medical Dictionary (1982). Its occurrence was identified as an unfamiliar non-technical word, clearly a misleading conclusion by common sense, though required by the operational definitions used in the study. In all, it can be concluded from the results of the test of hypothesis two, that it is possible to prepare written materials which convey a health education message but, which are at the readability level of grade 8 or lower. Furthermore, the difficult technical terminology in the pamphlets can be modified, indicating that the health education message can be conveyed using technical words which can be understood by the average reader.

Hypothesis Three

The testing of hypothesis three was undertaken to determine whether high readability levels of the pamphlets would be associated with some recurrent difficult technical words which occurred four or more times across or within pamphlets. The division point of

Dale-Chall readability score of 6.9 was chosen to divide the pamphlets into those with a readability level of grade 8 or lower and those higher than grade 8 reflecting the ability of the average reader as defined. The results of the across pamphlet analysis on both the "Preventative" and "Restorative" pamphlets revealed that the actual frequency of difficult technical words recurring in four or more pamphlets was different for pamphlets of readability levels below and above grade 8 from the expected frequency at a level of significance of 5% and beyond, allowing the conclusion that the readability levels of pamphlets are contingent in part, on some difficult technical words which are used repeatedly in the pamphlets. By contrast the actual frequency of difficult technical words which recurred four or more times within a pamphlet, did not differ significantly below and above grade 8 at the 5% level, from the difficult technical terminology occurring fewer than four times in a pamphlet. Thus it can be concluded that, unlike the recurrent difficult technical words across four or more pamphlets, the readability levels of neither the "Preventative" nor "Restorative" pamphlets were contingent on the recurrence of words four or more times within a pamphlet, and the readability level of any particular pamphlet was associated with the occurrence within that pamphlet of several different difficult technical words.

Some observations can be made about the recurrent difficult technical terminology. There is a fund of technical language clearly associated with health, and it may be that words recur because they are being drawn from this specific vocabulary. If this is the case, when the words are identified as being exclusively technical and difficult, care can be taken to avoid their use. If a difficult technical word occurs many times in one pamphlet, it is usually a title word of the pamphlet. For example, 'insulin' occurred 13 times in the passages from "Let's Talk About Insulin", and 'cancer' occurred 12 times in the passages from 'Facts on Skin Cancer'. Perhaps in light of what has already been discussed about title words in pamphlets having educational value, the recurrence of these words is not a disadvantage. However, it bears repeating that caution must be employed to ensure that these words are explained, using words which can be understood by the average reader of the pamphlet.

The word 'problem' occurred most frequently (36 times). Even though this word is in the Stedman's Medical Dictionary, it is not a word which one associates exclusively with health. Similarly 'method', 'increase', and 'control' recur, and while unfamiliar, do not have their most obvious meanings in the field of health. At least six of the recurrent difficult technical words: disease, physical; patient; physician; medical; and illness are health-related words which one reads and hears frequently. One conclusion which may be drawn is that the recurrent use of words in health education pamphlets, which do not have their most obvious meaning in the field of health, is probable because of the underlying assumption that since the words seem familiar to the professional educator, they are understood by all. The Dale-Chall readability formula detects these words (and their effect on readability) which are frequently used by writers of health education materials, but which are nonetheless difficult for the average reader to understand.

Conclusions

It can be concluded from the overall results of the study, that with the "Preventative" subject matter groups of 'Family Planning, Prenatal and Sexuality', 'Fitness', 'Mental Health', 'Nutrition', 'Smoking, Alcohol and Drug Abuse' and 'Parenting', and within the "Restorative" subject matter groups of 'Aging', 'Cancer', 'Cardiovascular', 'Communicable Diseases', 'Diabetes', 'Mental Health' and 'Respiratory', the health education pamphlets in use at the Edmonton Local Board of Health, or in settings distributing similar pamphlets from the same subject matter groups, are written at readability levels higher than grade 8, and thus, the pamphlets are written at a level of difficulty too high for them to be understood by the average person. It seems self-evident, but must be stressed, that if a pamphlet cannot be understood by the intended reader, then its usefulness as a teaching method is effectively negated. The pamphlets must be prepared at a readability level of grade 8 or lower if they are to be understood by the average person. With the exception of one study based on a sample of four, this finding is in keeping with all other research on the readability of health education materials. Furthermore, the Dale-Chall readability scores of the pamphlets exhibited a high positive correlation with the difficult technical terminology in the pamphlets. Based on this correlation, one can conclude that for any pamphlets within the range of readability scores identified in the present study, there will be a direct increase in the readability levels of health education pamphlets, as the number of difficult technical words increase, and conversely there will be a direct decrease in the readability levels of the pamphlets, as the number of difficult technical words decrease. If the pamphlets are to be a useful teaching tool for those with a reading ability of grade 8 or lower it is evident that the number of difficult technical words must be kept as low as possible.

It was demonstrated in the study, that the difficult technical terminology in the pamphlets could be replaced by technical terminology which was synonymous or similar in meaning, but less difficult to understand. A comparison of the mean drop in the Dale-Chall readability scores between the original and revised versions indicated a reduction in the Dale-Chall readability scores to a statistically significant degree. This type of revision of health education pamphlets has not been previously reported, but if the present results can be replicated, their practical significance cannot be ignored, since they demonstrated that if care is taken to control for difficult technical words in the terminology used, it is possible to prepare written materials which teach about health-related matters, which attain the desirably low readability levels. This conclusion is of considerable importance to health educators who prepare or teach from the pamphlets, because it demonstrates that the usefulness of the pamphlets can be enhanced by preparing them using language which the average person will understand.

Although care was taken to ensure that the replacement terminology in the passages conveyed the same meaning as the original materials, there were occasions when the investigator had difficulty thinking of an appropriate substitute word or words to use. One might speculate that if a writer of health education materials had a similar difficulty in thinking of a technical word which would be understood by the average reader, that writer might well choose instead, to use a technical word which is readily understood by health care professionals, but is in fact, a difficult technical word. If however, that same writer had access to a list of difficult technical words, and some synonymous word understood by the average reader, it is likely that the more readily understood words would be used in the written materials, leading to the conclusion that there is a need to develop, as a resource for health educators, a vocabulary of the difficult technical words, accompanied by synonymous words which could be used to convey the health teaching to the average person.

The need to explain any difficult technical terminology which is used in the pamphlets was discussed in the present study, as was the need to explain any concepts which might not be understood by a reader. The importance of ensuring that the words used to convey a health message are either words which the average reader will understand, or are accompanied by explanation which will be understood, can not be overemphasized. The pamphlets will have absolutely no use as a teaching aid method, if they are incomprehensible to the reader.

The present study indicates that the readability levels of health education pamphlets are contingent, in part, on difficult technical words which recur in at least four pamphlets, leading to the conclusion that there is a basic technical vocabulary which is used repeatedly by those preparing educational materials. Care must be taken to avoid using, or to explain, those frequently used difficult technical words. By contrast, the difficult technical words which recur four or more times within a pamphlet are independent of the readability levels of pamphlets below or above grade 8. Therefore, even though a difficult technical word which occurs several times within a pamphlet, will contribute to the high readability level of that particular pamphlet, it will not necessarily contribute to the overall high readability levels of the pamphlets in general. However, as evidenced by the previously mentioned example of the pamphlets describing example of the pamphlets describing varicose veins, if a word appears several times within a pamphlet, the readability level of that particular pamphlet remains higher than it otherwise would. It can be concluded that the presence of the difficult technical words are the reason for that high readability level, and those words must be explained, if their presence in the pamphlets is to be retained for some purpose such as teaching or as a diagnostic label.

It can be concluded that those pamphlets which contain preventative content (labelled "Preventative" in the present study), have significantly lower readability levels than do those which contain restorative content (labelled "Restorative" in the present study). Similarly the pamphlets which contain preventative content have a significantly lower percentage of difficult technical terminology than do those pamphlets which contain restorative content. Of all of the pamphlets analyzed, for the average reader the pamphlets dealing with 'Parenting' would be the most easily understood, while the 'Family Planning, Pre-natal and Sexuality' would be the most difficult for the average person to understand. When pamphlets are used for health teaching, educators who have been cautioned that there are particular subject matter pamphlets containing more than the usual proportion of difficult technical words will be able to use this knowledge and avoid using the difficult to understand words.

It will be recalled that a Dale-Chall readability score of approximately 5.5 to 6.5, was achieved in 23 of the 50 pamphlets, under substitution of difficult technical terminology. This drop in the Dale-Chall scores of the pamphlets is important to note because it means that by reducing the number of difficult technical words in the pamphlets, almost half (46%) of them could be brought to within the recommended readability level of materials for the average reader. Moreover, if all of the difficult technical terminology, had been removed, it seems likely that the target level would have been achieved for several more pamphlets. This approach, while practical, was not in keeping with the predetermined criteria for replacement of difficult technical words adopted in the study. It is noteworthy however that the likelihood that the readability levels of many more pamphlets would have been reduced to a Dale-Chall score of 6.5 or lower if all of the difficult technical terminology had been removed, supporting the conclusion that it is possible to decrease the readability levels of health education pamphlets in a direct relationship to the number of difficult technical words.

The discussion of the readability analysis of the three hypotheses indicate that 41 of the 50 (82%) of the pamphlets are too difficult for the average reader to understand, and that one of the contributing factors which can be more or less modified, is the difficult technical terminology used in the pamphlets. The results can be generalized to all agencies using the same health education pamphlets in the subject matter groups tested, as those on record at the Health Promotion Division, Edmonton Local Board of Health. These findings have important implications within the limitations of the present study which impose constraints on the generalizability of the results, but which do not diminish the importance of the findings as a contribution to the knowledge which will help nurses to inform, advise or teach the public about health from the preventative and restorative perspective.

Implications and Limitations of the Study

The implications arising from this study are far reaching for professional health educators including nurses. As educators, nurses should be aware of the importance to the individual of being in control of personal decision making, as it relates to making life comprehensible, manageable and meaningful as opposed to incomprehensible, unmanageable and meaningless in the face of threat to health. The ramifications for nursing, of the importance to an individual of controlling the major health-related decisions, are that a person can have the desire to make the decisions, but without knowledge, these decisions cannot be based on informed choice.

Nurses are bound by the practice standards of the profession to provide the patient with as much information as possible about a regimen of preventative or restorative care, to enable that individual to make informed decisions about managing his own care. Since much of the teaching directed toward helping an individual make decisions about health practices is provided in written form, if that individual cannot understand the words which are written in the instruction, there will be limited opportunity to use the information in the material in order to make a decision on which to take informed action.

Pamphlets intended to teach about health must be written so that they can be understood by the average reader. Nurses who are writing the materials must remember that the general public is not familiar with health-related language, nor with the functions and organs of the body, and care must be taken to use the most simple words which accurately convey the meaning. Furthermore, explanation using simple words should accompany any technical words used which a reader might not understand.

Nurses who are using health education pamphlets as a teaching aid must remember that there are probably difficult technical words in the pamphlets which will not be understood by the average reader, and these words must be identified and explained as part of the teaching process.

The major limitation of the study results from a design error resulting in the sample not being selected from the total population of pamphlets. In the study, 80% of the population (see page 49) was misinterpreted to mean 80% of the subject matters, instead of 80% of all subject matter represented in the population. As a result, the findings can be generalized only to those pamphlet groups having the same subject matter content as the pamphlets in the present study. The results can be generalized to the subject matter groups of "Preventative" pamphlets teaching about 'Family Planning, Pre-natal and Sexuality', 'Fitness', 'Mental Health', 'Nutrition', 'Smoking, Alcohol and Drug Abuse' and 'Parenting', but not to the subject matter groups teaching about 'Aging', 'Cancer', 'Cardiovascular', 'Diabetes', 'Epilepsy', 'Immunization and Disease Protection', 'Respiratory Care' or 'Vision' because these were not included in the sampling frame. In the "Restorative pamphlets, the results can be generalized to the subject matter groups of 'Aging', 'Cancer', 'Cardiovascular', 'Communicable Diseases', 'Diabetes', 'Mental Health' and 'Respiratory', but not to the subject matter groups teaching about 'Arthritis', 'Epilepsy', 'Hearing', 'Medications', 'Scoliosis', 'Parenting' or 'Vision'.

Another limitation of the study results from the possible bias introduced by the investigator, when the instructions were given to the judges (Appendix D). In providing the judges with the Dale-Chall list of 3000 familiar words, and asking them to suggest alternate replacement words, their assessment of whether or not the revised words conveyed the same meaning as the original might have been influenced in their tendency to identify or not identify a word as requiring replacement, if they were "expected" to come up with a better suggestion.

A limitation in the design of the study resulted in the possible association between the readability levels of the pamphlets and the difficult technical polysyllabic words which they contain, not being investigated. The effect found may, in fact, be accounted for by polysyllabicity taken alone, though on the face of it this can not be affirmed or disconfirmed.

The final limitation relates to the use of the Dale-Chall readability formula. Since the reliability of the formula is assumed and not empirically established, one must regard the results as tentative only. One can argue that the concurrent validity of the Dale-Chall formula offers some counter control on the reliability of the formula, and one can further argue that, of the readability formulae in current use, the Dale-Chall formula consistently yields the closest results to empirically established levels of reader difficulty with written material. However, reliability of the formula per se should be empirically established.

A fitting conclusion to the discussion of the present study is the reminder to a health educator, that when developing or using written health education materials, the readability level of a pamphlet is only one factor in the total process of reader comprehension of the material. The personal characteristics which the reader brings to the material, and the many facets of legibility of the material, will all be factors in how the reader comprehends the material, but what the writer of the pamphlet has control over, is the material and the contributions to comprehensibility, of the words used which, all else being equal, determine whether or not the average reader will understand the material.

Recommendations for Further Study

In the present study, the difficult technical terminology has been shown to be a significant factor in the readability levels of health education pamphlets, and these results await affirmation through further study. Furthermore, since it has been demonstrated that health education materials can be written using words which are likely to be understood by the average reader, it is a recommendation from this study that attention be directed toward further identification of difficult technical terminology which is used in pamphlets, and preparation of a list of synonymous, but more familiar words which those preparing educational materials could use.

In the present study there were differences between the number of difficult technical words found in "Preventative" and "Restorative" pamphlets, and in the number of difficult technical words found in the specific subject matter groups. It is recommended that these differences in the number of difficult technical words in various specific content materials be further investigated.

It is apparent from the literature that many readability formulae are being used in readability analyses of health education material, but it appears that there has been no attempt to determine which formula is the most useful instrument for health care research, based on an assessment of the validity, convenience and limitations of each. It would be useful to have a concentrated research effort directed toward choosing a single instrument to be used for the readability analyses of health education materials.

Because it was found in the present study that 81% of the difficult technical words were polysyllabic (three or more syllables), it is recommended that specific testing be conducted on the readability levels of health education pamphlets, as a function of the number of syllables in the technical words in those pamphlets, and the contribution over and above that, of technical words of one or two syllables.

CHAPTER V

SUMMARY

The purpose of the present study was to examine the contribution of difficult technical language to the readability of health education pamphlets in use, and thereby add to the general body of knowledge concerning the comprehensibility, and therefore usefulness, as a means of educating the public on health matters.

The study evolved in light of a review of the literature which reveals that adults do try to use pamphlets to learn more about health, but there is a group in the population, who would be unable to understand the instructional materials because: the pamphlets typically are prepared at a level of reading difficult higher than grade 8; 20% of all Canadians over the age of 15 have only a grade 8 or lower education; a group of adults of unknown size have completed secondary schooling but are unable to read at a grade 8 level; and many adults, regardless of educational attainment, are unable to understand the words associated with health.

The study was based on a framework of reading comprehension comprised of the attributes of the reader, the specific situational features for the reader, and the readability of the material being read. The present study addresses the readability component, defined as all of the attributes of material which make it difficult or easy for a person to understand. The singular focus of the study is placed on the vocabulary in the health education material.

The readability of the material is measured by a readability formula which is converted to a readability level. The Dale-Chall readability formula, used in the present study, yields a readability score, and if a grade level equivalent is required, this score can be converted to a readability level. The readability level is the educational grade level of reading ability required for a reader to understand the material.

The population of materials to be sampled was comprised of 437 health education pamphlets, identified by the Edmonton Local Board of Health as having suitable content for adult readers in the general public. The sampling frame was pamphlets representing 80% of the subject matter of the total population. According to pre-determined criteria, the pamphlets were split as to whether they contained "Preventative" or "Restorative" content, and a sample of 25 pamphlets was drawn from each of the two sub-populations.

Study results disclose that 9 of the 50 pamphlets had a Dale-Chall readability score of 6.9 (grade 8 readability level) or lower. Five hundred thirty-two difficult technical words occurred one or more times for a total of 1642 occurrences of difficult technical words across both groups of pamphlets, with 695 of the occurrences in the "Preventative" pamphlets, and 947 in the "Restorative" pamphlets.

The hypotheses in the study examined: the relationship between readability levels and the percentage of difficult technical terminology; the feasibility of reducing readability levels through words of synonymous meaning; and the contribution to the readability levels due to the recurrence of difficult technical words. The results reveal that the strength of the relationship between the Dale-Chall readability score and the percentage of difficult technical terminology under Pearson Product Moment correlation, revealed a high positive correlation for both the "Preventative" (r-.85), and "Restorative" (r=.79) groups of pamphlets, each significant at the 5% level.

Removal of the difficult technical words from the passages, and their replacement by substitute technical words which are on the Dale-Chall list of 3000 familiar words, when analyzed under analysis of variance for repeat measures, revealed that for both the "Preventative" and "Restorative" groups of pamphlets, there was a statistically significant drop (at the 5% level of significance) in the mean Dale-Chall readability scores between the original material and the passages after substitution.

The "Preventative" pamphlets had a mean Dale-Chall readability score drop of 1.2 points, to bring the mean Dale-Chall readability score of all 25 pamphlets to a Dale-Chall readability score of 6.6 (grade 7 readability level). The "Restorative" pamphlets had a mean Dale-Chall score drop of 1.4 points, to bring the mean score of all 25 pamphlets to a Dale-Chall readability score of 6.9 (grade 7 readability level).

When specific word recurrence in the 1642 occurrences of difficult technical words was analyzed under Chi-square analysis, in both the "Preventative" and "Restorative" groups of pamphlets, (at the 5% level of significance), there was a significant contribution made to the readability levels of the pamphlets from words which recurred across four or more pamphlets. The difficult technical words which recurred four or more times within a pamphlet did not contribute significantly to the readability levels of the "Preventative" or "Restorative" groups of pamphlets at the 5% level of significance.

The general conclusions drawn from the present study are that: health education pamphlets are prepared at a level of reading difficulty which is too high for the average reader to understand; difficult technical terminology contributes significantly to the readability levels of the pamphlets; it is possible to prepare written materials which convey the desired educational message about health, but which are readable at a grade 8 readability level; and that the use of some difficult technical words which recur across the pamphlets make a statistically significant contribution to the readability levels of the pamphlets.

The results of the study have implications for persons who, develop or teach by using health education pamphlets. This is particularly true of nurses, because nurses, in meeting the standards of practice of the profession, must ensure that the client and significant others have the knowledge and information necessary for free and informed decisionmaking concerning care requirements. Limitations related to: sampling the range of subject matter of pamphlets in use; reliability of the formula; and the polysyllabicity of the difficult technical words, restrict the generalizability of the results.

REFERENCES

Amster, H. (1965). Concept formation in children. In R.G. Stauffer (Ed.), Language and the Higher Thought Processes. Champaign, Illinois: National Council of Teachers of English.

Bakdash, M.B., Odman, P.A., and Lange, A.L. (1983). Distribution and readability of periodontal health education literature. Journal of Periodontology, 54, 538-541.

Bormuth, J.R. (1966). Readability: A new approach. Reading Research Quarterly, 1, 79-132.

Botel, M., & Granowsky, A. (1972). A formula for measuring syntactic complexity: a directional effort. Elementary English, 59, 513-516.

Boyle, C.M. (1970). Differences between patient's and doctor's interpretations of some common medical terms. British Medical Journal, 2, 286-289.

Brinton, J.E. and Danielson, W.A. (1958). A factor analysis of language elements affecting readability. Journalism Quarterly, 35, 420-426.

Canadian Nurses Association. (1980). A Definition of Nursing Practice. Ottawa: Canadian Nurses' Association.

Caron, H.S. (1965). An evaluation of the booklet, planning low sodium meals. Cited in Knutson, A.L. The Individual, Society and Health Behaviour, New York: Russell Sage Foundation.

Chall, J.S. (1958). Readability - An Appraisal of Research and Application. Columbus, Ohio: Bureau of Educational Research, Ohio State University.

Chall J.S. and Dale, E. (1950). Familiarity of selected health terms. Educational Research Bulletin, 29, 197-206.

Chall, J.S. and Dial, H. (1948). Predicting Listener Understanding and Interest in Newscasts. Educational Research Bulletin, 27, 141-153, 168.

Christ, W.G. and Pharr, P.P. (1980). Readability of Brochures Produced by Station of Florida. Journalism Quarterly, 57(1), 159-160.

Code of Ethics for Nursing. (1985). Ottawa: Canadian Nurses Association.

Cohen, J. (1977). Statistical Power Analysis for the Behavioral Sciences. New York: Academic Press, Inc.

Coleman, E.B. (1962). Improving comprehensibility of shortening sentences. Journal of Applied Psychology, 46, 131-134.

Coleman, E.B. (1971). Developing a technology for the determiners of the complexity of prose. In E.Z. Rothkopf and P.E. Johnson (eds.) Verbal Learning Research and the Technology of Written Instruction. New York: Teacher's College Press.

Dale, E. and Chall, J.S. (1948). A formula for predicting readability. Education Research Bulletin, 27, 11-20, 37-54.

Dale, E. and Chall, J.S. (1965). Developing readable materials. In: Adult Reading, Part II, Ch. 12. The Fifty-fifth Yearbook of the National Society for the Study of Education. Chicago: University of Chicago Press.

Dale, E. and Hager, H. (1950). Some Suggestions for Writing Health Materials. New York: National Tuberculosis Association.

Dale, E. and Tyler, R.W. (1934). A study of the factors influencing the difficulty of reading materials for adults of limited reading ability. Library Quarterly, 4, 384-412.

Doak, L.G. and Doak, C.C. (1980). Patient comprehension profiles: Recent findings and strategies. Patient Counselling Health Education, 3, 101-106.

Duffelmeyer, F. (1979). The effect of rewriting prose material on reading comprehension. Reading World, 23, 1-11.

England, G.W., Thomas, M., and Paterson, D.G. (1953). Reliability of the original and simplified Flesch Reading Ease formulas. Journal of Applied Psychology, 37, 111-113.

Entin, E.B., and Klare, G. (1978). Factor analyses of three correlation matrices of readability variables. Journal of Reading Behavior, 10, 279-290.

Fisher, G., and Yates, C. (1948). Statistical Tables for Biological, Agricultural and Medical Research. Edinburgh: Oliver and Boyd Ltd.

Flesch, R.F. (1948). A new readability yardstick. Journal of Applied Psychology, 32, 221-233.

Flesch, R.F. (1974). The Art of Readable Writing. New York: Harper and Row.

Freimuth, V. (1979). Assessing the readability of health education messages. Public Health Reports, 94, 568-570.

Fry, E. (1968). A readability formula that saves time. Journal of Reading, 11, 513-516, 575-578.

Gilliland, J. (1972). Readability. London: University of London Press Ltd.

Glazer, S.M. (1974). Is sentence length a valid measure of difficulty in readability formulas? The Reading Teacher, 27, 464-468.

Glazer-Waldman, H., Hall, K., Weiner, M.F. (1985). Patient education in a public hospital. Nursing Research, 34(3), 184-185.

Gray, W.S. and Leary, B. (1935). What Makes a Book Readable. Chicago: The University of Chicago Press.

Gunning, R. (1968). The Technique of Clear Writing. New York: McGraw-Hill.

Harber, J.R. (1979). Syntactic complexity: a necessary ingredient in predicting readability. Journal of Learning Disabilities, 12, 437-443.

Harrison, C. (1980). Readability in the Classroom. New York: Cambridge University Press.

Hayes, P.M., Jenkins, J.J., and Walker, B.J. (1950). Reliability of the Flesch readability formula. Journal of Applied Psychology, 34, 22-26.

Holcomb, C. (1981). Reading difficulty of informational materials from a health maintenance organization. Journal of Reading, 25, 130-132.

Hopkinson, J. (1983). Nursing guide to the readability of family planning pamphlets. Unpublished manuscript.

Huus, H. (1971). Critical aspects of comprehension. Elementary English, 42, 489-494.

Irwin, J.W. (1980). Implicit connectives and comprehension. Reading Teacher, 33, 527-529.

Jongsma, E.A. (1972). The difficulty of children's books: Librarians' judgements vs. formula estimates. Elementary English, 49, 20-26.

Kahn, M. (1978). Readability of drug education literature. Journal of Drug Education, 8, 305-311.

Klare, G. (1952). Measures of the readability of written communication: An evaluation. The Journal of Educational Psychology, 43, 385-399.

Klare, G. (1963). The Measurement of Readability. Ames, Iowa, Iowa State University Press.

Klare, G. (1976). A second look at the validity of readability formulas. Journal of Reading Behavior, 8, 129-152.

Klare, G., Mabry, J.E. and Gustafson, L.M. (1955). The relationship of human interest to immediate retention and to acceptability of technical material. Journal of Applied Psychology, 39, 92-95.

Konheim, B.G. and Naiman, D.N. (1954). An evaluation of free health literature in an adult education program - a study with parents of college students. American Journal of Public Health, 44, 216-222.

Leaf and The Lamp (The). (1968). Ottawa: The Canadian Nurses' Association.

Lee, W.D. and Belden, G.G. (1966). A cross-validation readability study of general psychology textbook material and the Dale-Chall readability formula. The Journal of Educational Research, 59, 369-373.

Ley, P. (1972). The comprehensibility of some x-ray leaflets. Journal of the Institute of Health Education, 10, 47-55.

Leichter, S.B., Nieman, J.A., Moore, R.W., Collins, P., and Rhodes, A. (1981). Readability of self-care instructional pamphlets for diabetic patients. Diabetes Care, 4, 627-630.

Liquori, S. (1979). A quantitative assessment of the readability of PPI's. Drug Intelligence and Clinical Pharmacy, 12, 712-716.

Lunzer, E.A. and Gardner, W.K. (Eds.). (1979). The Effective Use of Reading. Schools Council Project Report, London: Heinemann.

McLaughlin, G.H. (1969). SMOG Grading - A New Readability Formula. Journal of Reading, 22, 639-646.

Morris, L.A., Maxis, M., and Gordon, E. (1977). A survey of oral contraceptive patient information. Journal of the American Medical Association, 238, 2504-2508.

Morris, L.A. and Olins, N.J. (1984). Utility of drug leaflets for elderly consumers. American Journal of Public Health, 74, 157-158.

Morrison, I. (1975, March 11). Who's Literate? Globe and Mail, p. 9.

Muir, S. (1978). Cleaning the air of FOG and SMOG. Reading Horizons, 18, 285-288.

Nightingale, F. (1980). Notes on Nursing. Edinburgh: Churchill Livingstone, Inc. (Originally published, 1859.)

Oxford English Dictionary. (1971). Oxford: Oxford University Press.

Pauk, W. (1969). A practical note on readability formula. Journal of Reading, 13, 207-210.

Pearson, H. (1960). The Life of Oscar Wilde. Middlesex, England: Penguin Books.

Pellegrino, E.D. and Thomasma, D.C. A Philosophical Basis of Medical Practice. New York, Oxford: Oxford University Press, 1981.

Polit, D.F. and Hungler, B.P. (1983). Nursing Research: principles and methods. Philadelphia: J.B. Lippincott Company.

Powers, R.D., Sumner, W.A. and Kearl, B.E. (1958). A recalculation of four readability formulas. Journal of Educational Psychology, 49, 99-105.

Pyrczak, F. (1976). Readability of "Instructions for Form 1040". Journal of Reading, 20, 121-127.

Pyrczak, F. and Roth, D.H. (1976). The readability of directions on non-prescription drugs. Journal of American Pharmaceutical Association, 16, 242-267.

Razik, T.A. (1969). A study of American newspaper readability. The Journal of Communication, 19, 317-324.

Redman, B. (1980). The Process of Patient Teaching in Nursing. Toronto: C.V. Mosby Company.

Riley, C.S. (1966). Patient's understanding of doctor's instructions. Medical Care, 4, 34-37.

Samora, J., Saunders, L. and Larson, R.F. (1961). Medical vocabulary knowledge among hospital patients. Journal of Health and Human Behavior, 2, 83-92.

Smeltzer, C. (1980). Hypertensive patients' understanding of terminology. Heart Lung, 9, 498-502.

Spadero, D.C. (1983). Assessing readability of patient information materials. Pediatric Nursing, 9, 274-278.

Spadero, D.C., Robinson, L.A. and Smith, L.T. (1980). Assessing readability of patient information materials. American Journal of Hospital Pharmacy, 37, 215-221.

Stedman's Medical Dictionary, 1984, Baltimore, London: Williams and Wilkins, 24th ed.

Stolurow, L.M. and Newman, J.R. (1959). A factional analysis of objective features of printed language presumably related to reading difficulty. Journal of Educational Research, 52, 243-251.

Swanson, C.E. and Fox, H.G. (1953). Validity of readability formulas. Journal of Applied Psychology, 37, 114-118.

Thrush, R.S. and Lanese, R.R. (1962). The use of printed material in diabetes education. Diabetes, 11, 132-137.

Trapini, F. and Walmsley, S. (1981). Five readability estimates: Differential effects of simplifying a document. Journal of Reading, 24, 398-403.

Tring, F.C. and Hayes-Allen, M.C. (1973). Understanding and misunderstanding of some medical terms. British Journal of Medical Education, 7, 53-59.

Turner, J., Irwin, G. and Roy, D. (1981). Do patients read breast self-examination booklets? Health Education Journal, 40, 11-12.

Vivian, A.S. and Robertson, E.J. (1980). Readability of patient education materials. Clinical Therapeutics, 3, 129-136.

von Glaserfeld, E. (1970-71). The problem of syntactic complexity in reading and readability. Journal of Reading Behavior, 3(2), 1-11.

Walker, G.P. (1975). STAR Test readability estimation (Computer program). General Motors BASIC program. Revised S. Davies, 1977, Nottingham University. Revised D.J. Bush, 1978, Middlesex Polytechnic.

Wilson, J. and Hogan, L. (1983). Readability testing of auxiliary labels. Drug Intelligence Clinical Pharmacy, 17, 54-55.

Wingert, W.A., Grubbs, J.P., and Friedman, D.B. (1969). Why Johnny's parents don't read: An analysis of indigent parents' comprehension of health education materials. Clinical Pediatrics, 8, 655-660.

Worthington, J.S. (1977). The readability of footnotes to financial statements and how to improve them. Journal of Reading, 20, 469-478.

APPENDIX A

THE DALE-CHALL FORMULA (1948)*

The Dale-Chall formula uses a word list as a basis for predicting vocabulary difficulty. The Dale list of 3,000 words was originally derived from research into the words best known to American eight-year-olds. The formula is as follows:

US grade = (0.1579 x PERCENT UFMWDS),
+ (0.0496 x WDS/SEN)
+ 3.6365

where UFMWDS = unfamiliar words (for definition, see below)

and WDS/SEN = average number of words per sentence

The selection of samples for analysis of articles requires that three to four 100 word samples be selected per 2,000 words. For passages of 200 to 300 words, the complete passage is analyzed. Samples always begin and end with a complete sentence.

In the light of experience gained in applying their formula to passages of various types, and comparing the formula's prediction with the judgements of experts, Dale and Chall came to feel that the formula scores might be slightly underestimating the difficulty of harder materials. They therefore suggested that the formula score should be converted to a 'corrected grade level'. The 'corrected age levels' below represent the Dale and Chall transformation table.

---

*The complete description of the rules for application of the Dale-Chall readability formula can be found in:
Dale, E. and Chall, J.S. (1948). A formula for predicting readability. Educational Research Bulletin, 27, 11-20, 37-54.

Dale-Chall Formula Score

Dale-Chall Readability Score	Equivalent Grade Level
4.9 and below	grade 4 and below
5.0 - 5.9	grade 5-6
6.0 - 6.9	grade 7-8
7.0 - 7.9	grade 9-10
8.0 - 8.9	grade 11-12
9.0 - 9.9	grade 13-15 (college)
10.0 and above	grade 16 (college grad)

There are a number of rules for deciding what may be regarded as a 'familiar' word.

Common Nouns

Consider familiar all regular plurals and possessives of words on the list. For example, because boy, girl, church, and army are on the list, boy's (possessive), girls, churches, and armies (regularly formed plurals) are familiar.

Count irregular plurals as unfamiliar, even if the singular form appears on the list; oxen is unfamiliar, although ox is on the list. However, when the plural appears as a separate word or is indicated by the ending in parentheses next to the word, it is considered familiar; goose and geese appear on the list and both are considered familiar.

Count as unfamiliar a noun that is formed by adding -er or -r to a noun or verb appearing on the word list (unless this er or r form is indicated on the list); burner is counted as unfamiliar, although burn is on the list. Owner is considered familiar because it appears on the list as own(er).

Proper Nouns

Names of persons and places are considered familiar. Japan, Smith, and so on, are familiar even though they do not appear on the word list.

Names of organizations, laws, documents, titles of books, movies, and so on generally comprise several words.

(a) When determining the number of words in a sample, count all the words in the name of an organization and the like. Chicago Building Association should be counted three words. Declaration of Independence should be counted three words. Special rule: when the title of an organization, law, and so on is used several times within a sample of 100 words, all the words in the title are counted, no matter how many times they are repeated.

(b) For the unfamiliar word count, consider unfamiliar only words which do not appear on the Dale list, except names of persons or places. Chicago Building Association is counted one unfamiliar word (Association) since Building and Chicago are familiar. Declaration of Independence is counted as two unfamiliar words - as of is on the list. Special rule: When the name of an organization, law, document, and so on is used several times within a sample of 100 words, count it only twice when making the unfamiliar word count. Security Council, if repeated more than twice within a 100-word sample, is counted as four unfamiliar words.

Abbreviations

(a) In counting the words in a sample, an abbreviation is counted as one word. Y.M.C.A., Nov., a.m. and p.m. are each counted as one word.

(b) In making the unfamiliar word count, an abbreviation is counted as one unfamiliar word only. Y.M.C.A. is considered one unfamiliar word. Nov. is considered familiar because the names of the months are on the word list. U.S., a.m. and p.m. are each considered familiar. Special rule: an abbreviation which is used more than twice within a 100-word samle is counted as two unfamiliar words only. C.I.O. is counted two unfamiliar words if repeated five times in a 100-word sample.

Verbs

Consider familiar the third-person, singular forms (-s, or -ies from y), present-participle forms (-ing), past-participle forms (-n), and past-tense forms (-ed, or -ied from -y), when these are added to verbs appearing on the list. The same rule applies when a consonant is doubled before adding -ing or -ed. For example, ask, asking, asked, dropped and dropping are considered familiar, because ask and drop appear on the word list.

Adjectives

Comparatives and superlatives of adjectives appearing on the list are considered familiar. The same rule applies if the consonant is doubled before adding -er or -est. For example, longer, prettier, and bravest are familiar because long, pretty, and brave are on the list; red, redder, and reddest are all familiar.

Adjectives formed by adding -n to a proper noun are familiar. For example, American, Austrian.

Count as unfamiliar an adjective that is formed by adding -y to a word that appears on the list. But consider the word familiar if -y appears in parentheses following the word. Eg. wooly is unfamiliar although wool is on the list; sandy is familiar because it appears on the list as sand(y).

Adverbs

Consider adverbs familiar which are formed by adding -ly to a word on the list. (In most cases -ly is indicated following the word.) Soundly is familiar because sound is on the list.

Count as unfamiliar words which add more than -ly or change a letter, like easily.

Hyphenated Words

Count the hyphenated words as unfamiliar if either word in the compound does not appear on the word list. When both appear on the list, the word is familiar.

Miscellaneous Special Cases

Words formed by adding -en to a word on the list (unless the -en is listed in parentheses or the word itself appears on the list) are considered unfamiliar; sharpen is considered unfamiliar although sharp is on the list; golden is considered familiar because it appears on the list gold(en).

Count a word unfamiliar if two or more endings are added to a word on the list; clippings is considered unfamiliar, although clip is on the list.

Words on the list to which -tion, -ation, -ment, and other suffixes not previously mentioned are added are considered unfamiliar, unless the word with the ending is included on the list; treatment is unfamiliar although treat is on the list; protection is unfamiliar although protect is on the list; preparation is unfamiliar although prepare is on the list.

Numerals like 1947, 18 and so on, are considered familiar.

APPENDIX B

EXAMPLES OF FIVE "PREVENTATIVE" AND FIVE "RESTORATIVE" PASSAGES IN ORIGINAL FORM AND AFTER REVISION OF DIFFICULT TECHNICAL TERMINOLOGY*

I.D. Code	Title	Page
PF40	- Exercise at the Office	122
PN80	- Let's Talk About Nutrition	124
PP105	- Will I Ever Sleep Again?	126
PP107	- Do You Know Your Child?	128
PS144	- Alcohol and Your Unborn Baby	130
RCV38	- Living With A Heart Ailment	132
RCV45	- Varicose Veins	134
RCD72	- AIDS	136
RD102	- Diabetes - A Manual for Canadians	138
RR154	- Chronic Cough	140

*Words underline in the original passages are those difficult technical words which were changed. Word underlined in revised passages are corresponding synonymous words or phrases.

EXERCISE AT THE OFFICE - Original (PF40)

The human body is the only machine that breaks down when not used. To prevent premature aging or degeneration of muscles and joints, it is essential to use them every day. Daily light exercise will improve your posture, flexibility and muscle-power. Pressure and tension are a part of everyone's working day. Exercise on the job helps an individual relax and cope better with stress. Physical activity everyday, even in brief amounts is essential for weight control. Physical movement burns up calories in a cumulative manner throughout the day. It makes sense to include regular light exercise in your working day.

Let the head fall forward and to right side in smooth motion, then focus eyes. Continue by relaxing head down and across to other side. (For neck and upper back muscles, release of tension.) While standing, lean as far as is comfortable to each side reaching down the leg with the hand. (Increases flexibility and helps firm waist and upper trunk.) With arms relaxed and feet apart, slowly twist around each side and back, following the leading hand with your eyes. Avoid violent twisting. Bend arms, lowering body to desk and then back up. Keep body straight.

Sit at your desk, back pushed into back of the chair. Lift both legs and gently flutter kick. Relax. Now raise each leg one at a time and circle the foot from the ankle. (For abdominals, legs and ankles.) Touch back of chair with one hand for balance. Swing outside arm and leg back and forth in opposite directions. Repeat on the other side. (Firms legs, relaxes shoulders.) Reach over right shoulder with right hand while bending left arm up the back to try to touch hands. Relax by dropping arms to sides. Alternate. Sit in chair with arms relaxed.

EXERCISE AT THE OFFICE - Revised (PF40)

The human body is the only machine that breaks down when not used. To prevent early aging or weakening of the parts of the body that help you move, they must be used every day. Daily light exercise will improve how you stand, flexibility and how strong you are. Worries and too little time are a part of everyone's working day. Exercise on the job helps an individual wind down and deal better with worries. More body activity everyday, even in brief amounts is needed to keep pounds off. Moving about burns up calories (that part of food which adds pounds) in a manner that adds up throughout the day. It makes sense to include regular light exercise in your working day.

Let the head fall forward and move smoothly to right side, then look at a set point to fix the eyes. Continue by dropping the head down and across to other side. (For neck and upper back release of tight feeling.) While standing, lean as far as is comfortable to each side reaching down the leg with the hand. (Adds more flexibility and helps firm waist and upper trunk.) With arms relaxed and feet apart, slowly twist around each side and back, following the leading hand with your eyes. Avoid violent twisting. Bend arms, lowering body to desk and then back up. Keep body straight.

Sit at your desk, back pushed into back of the chair. Lift both legs and gently flutter kick. Go limp. Now raise each leg one at a time and circle the foot. (For lower body, upper and lower legs.) Touch back of chair with one hand for balance. Swing outside arm and leg back and forth in opposite directions. Repeat on the other side. (Firms legs, makes shoulders less tight.) Reach over right shoulder with right hand while bending left arm up the back to try to touch hands. Rest by dropping arms to sides. Alternate. Sit in chair with arms limp.

LET'S TALK ABOUT NUTRITION - Original (PN80)

Nutrition helps you and your family keep healthy and feeling good in every way. Poor food habits have been linked to cardiovascular disease, stress, tooth decay and obesity. About 50% of Canadians are overweight you know. Agreed. And others may feel the same way too. In a recent survey conducted for Health and Welfare Canada, seven out of ten Canadians said the cost of food is important in deciding eating habits. Put variety, moderation and balance in your food choices and include them in your personal goals. Not necessarily if you plan ahead and spend your food dollar wisely.

If you feel the store should have more variety or better quality food, or if prices seem higher than normal, speak to the manager. Protect your interests. Read labels. Shop for less expensive brands. Develop consumer know-how. Its your money. Add variety by eating out occasionally. But think about the cost and health implications of wine, beer or liquor which can be half a restaurant bill. Think about other extras: do you really need rolls before a meal, an appetizer or a rich dessert? For a change invite friends or family to your home and once in a while serve low cost dishes from different countries.

If you indulge in sugar laden desserts, snacks or drinks why not try to reduce the portions or number of servings. Better still, substitute fruit or juice which are usually cheaper. Most Canadians consume more salt (sodium) than they need - often from convenience foods or the salt shaker. Using less salt - wherever you miss it least - makes sense and may help control high blood pressure. And in stressful times you may not be able to resist the temptation of impulse eating as an escape. So plan for your impulse foods now and then.

LET'S TALK ABOUT NUTRITION - Revised (PN80)

Proper meals helps you and your family keep healthy and feeling good in every way. Poor food habits have been linked to heart attack, worry, bad teeth, and being too fat. About 50% of Canadians are overweight you know. Agreed. And others may feel the same way too. In a recent survey conducted for Health and Welfare Canada, seven out of ten Canadians said the cost of food is important in deciding eating habits. Put variety, moderation and balance in your food choices and include them in your personal goals. Not necessarily if you plan ahead and spend your food dollar wisely.

If you feel the store should have more variety or better quality food, or if prices seem higher than normal, speak to the manager. Protect your interests. Read labels. Shop for less expensive brands. Develop consumer know-how. Its your money. Add variety by eating out occasionally. But think about the cost and health implications of wine, beer or liquor which can be half a restaurant bill. Think about other extras: do you really need rolls before a meal, an appetizer or a rich dessert? For a change invite friends or family to your home and once in a while serve low cost dishes from different countries.

If you indulge in sugar laden desserts, snacks or drinks why not try to reduce the portions or number of servings. Better still, use fruit or juice which are usually cheaper. Most Canadians consume more salt (sodium) than they need - often from convenience foods or the salt shaker. Using less salt - wherever you miss it least - makes sense and may help lower high blood pressure (too much pressing of the blood against blood vessel walls). And in stressful times you may not be able to resist the temptation of impulse eating as an escape. So plan for your impulse foods now and then.

WILL I EVER SLEEP AGAIN? - Original (PP105)

Babies wake during the night - when they do they usually cry. This is frustrating to parents who want and need a good night's sleep. How do you deal with night wakings? For most babies there seems to be stages in their sleeping behavior. The following are suggestions for dealing with some of the difficulties you may encounter. In the early weeks, a baby sleeps as much as 14 hours a day. The longest sleep period is usually four to five hours at a time. She also sleeps differently from an adult; a more restless as opposed to deep sleep.

When your baby shows signs of being able to sleep through the night, she may need some gentle persuasion such as: Try to keep feedings three or four hours apart. This will impose some regularity on her schedule. (If you use demand feeding, then imposing a night time schedule may take longer.) Expect some crying and be willing to tolerate and ignore it. This will be difficult but will break the habit of crying everytime she wants attention. Teach her to associate sleep with her own crib and not with your arms or your bed.

Are you teaching your child to cry and resist rather than to fall asleep? Are you postponing bedtime if she resists the first time? Children tend to take advantage of inconsistency so be consistent. The solution may be to stop responding when she cries or resists. Proceed with bedtime routines, then leave her alone to sleep. Ignore fussing or crying and her resistance will probably disappear within a few nights. Put toys or books by her bed and tell her: if you wake up before we do, Judy, play with your toys for a little while and then I'll come and get you.

WILL I EVER SLEEP AGAIN? - Revised (PP105)

Babies wake during the night - when they do they usually cry. This is frustrating to parents who want and need a good night's sleep. How do you deal with night wakings? For most babies there seems to be stages in their sleeping habit. The following are suggestions for dealing with some of the difficulties you may encounter. In the early weeks, a baby sleeps as much as 14 hours a day. The longest sleep stretch is usually four to five hours at a time. She also sleeps differently from a grown person; a more restless as opposed to deep sleep.

When your baby shows signs of being able to sleep through the night, she may need some gentle persuasion such as: Try to keep feedings three or four hours apart. This will impose some a more regular habit. (If you use demand feeding, then imposing one set time to feed at night time may take longer.) Expect some crying and be willing to tolerate and ignore it. This will be difficult but will break the habit of crying everytime she wants attention. Teach her to associate sleep with her own crib and not with your arms or your bed.

Are you teaching your child to cry and resist rather than to fall asleep? Are you postponing bedtime if she resists the first time? Children tend to take advantage of inconsistency so be consistent. The solution may be to stop responding when she cries or resists. Proceed with bedtime routines, then leave her alone to sleep. Ignore fussing or crying and her resistance will probably disappear within a few nights. Put toys or books by her bed and tell her: if you wake up before we do, Judy, play with your toys for a little while and then I'll come and get you.

DO YOU KNOW YOUR CHILD? - Original (PP107)

A wise physician once said there is no such thing as a bad child. There is no such thing as a good child either. There are only happy children and unhappy children, healthy children and unhealthy children. That's the theme of this booklet. It seems a simple enough premise, yet too many of us don't agree with it and don't understand it. Fifty or sixty years ago we knew little scientifically about ourselves and our children. We were sometimes cruel without realizing it. We were sometimes ignorant without realizing it.

The mistake here is that the parent believes the child knows what it is doing. The child is usually unaware that it is behaving a certain way to get attention. By telling the child what its possible motives are we are not helping the child change its attitude or behavior. We merely increase the child's anxieties. With some children we help create feelings of guilt, adding to their feelings of anxiety. If the dinner table (or breakfast or lunch table) atmosphere has been a relaxed healthy one in the first place, the chances are that the child would not have developed an eating problem.

It is and it isn't. As a general rule we can assume that happily married couples will have children who will be happier than those of unhappily married parents. Having stated the general rule, we also know that many a home where husband and wife adore each other, respect each other, never argue in front of the children, never lose their tempers, still have emotional problems. How come? Again there may be a variety of reasons. Lets take one example. Mr. and Mrs. John Smith are very much in love. They have been married three years. They have one child, a daughter.

DO YOU KNOW YOUR CHILD? - Revised (PP107)

A wise doctor once said there is no such thing as a bad child. There is no such thing as a good child either. There are only happy children and unhappy children, healthy children and children who are not healthy. That's the theme of this booklet. It seems a simple enough premise, yet too many of us don't agree with it and don't understand it. Fifty or sixty years ago we knew little scientifically about ourselves and our children. We were sometimes cruel without realizing it. We were sometimes ignorant without realizing it.

The mistake here is that the parent believes the child knows what it is doing. The child is usually unaware that it is behaving a certain way to get attention. By telling the child what its possible reasons are we are not helping the child change its ways of thinking or behaving. We merely add to the child's worries. With some children we help create a feeling of guilt, adding to the worry they feel. If the dinner table (or breakfast or lunch table) atmosphere has been an easy-going, healthy one in the first place, the chances are that the child would not have developed trouble with eating.

It is and it isn't. As a general rule we can assume that happily married couples will have children who will be happier than those of unhappily married parents. Having stated the general rule, we also know that many a home where husband and wife adore each other, respect each other, never argue in front of the children, never lose their tempers, still have trouble handling how they feel. How come? Again there may be a variety of reasons. Lets take one example. Mr. and Mrs. John Smith are very much in love. They have been married three years. They have one child, a daughter.

ALCOHOL AND YOUR UNBORN BABY - Original (PS144)

For most women pregnancy is a time of intense, often mixed feelings. The good feelings can be very good - anticipation, pride, excitement, a sense of fulfillment. But because having a baby is such an important event in one's life, it is also natural to experience some doubts and fears along with the highs. One way to deal with these feelings is to make sure you are doing everything possible to keep you and your baby healthy. Regular prenatal check-ups and a nutritious diet are important. What you eat and what you drink will contribute to the health of your baby.

In the last few years researchers have conducted a number of studies on infants born to women who drank heavily during their pregnancies. A significant number of the infants born to these women had definite patterns of physical, mental and behavioral abnormalities which researchers named the fetal alcohol syndrome. The babies with this syndrome were shorter and lighter in weight than normal and didn't catch up even after special postnatal care was provided. They also had abnormally small heads, several facial irregularities, joint and limb abnormalities, heart defects, and poor coordination.

Pregnancy changes your life in some important ways and you're bound to feel some stress during this period. It may happen that a few friendly drinks will seem like a good antidote to whatever is troubling you. At those times, stop and try to think of other ways you might handle your feelings. It may help to talk to someone about what is bothering you. Or you may prefer to walk, listen to music or write out the things that you are feeling. You may be surprised at how effective some of these alternatives to alcohol can be. Social situations always seem to call for a drink.

ALCOHOL AND YOUR UNBORN BABY - Revised (PS144)

For most women having a baby is a time of intense, often mixed ways of feelings. A good feeling can be very good - anticipation, pride, exciting, a sense of fulfillment. But because having a baby is such an important time in one's life, it is also natural to have some doubts and fears along with the highs. One way to deal with how you feel is to make sure you are doing everything possible to keep you and your baby healthy. Regular check-ups before the baby is born and a nutritious food are important. What you eat and what you drink will contribute to the health of your baby.

In the last few years researchers have conducted a number of studies on babies born to women who drank heavily while carrying their babies. A significant number of the babies born to these women had definite patterns of many things wrong with them which researchers named the fetal alcohol syndrome. The babies with this syndrome were shorter and weighed less than most babies and didn't catch up even after special care was provided. They also had smaller heads than most babies, several had faces, arms and legs that were not formed correctly, heart damage, and poor use of arms and legs.

Child-bearing changes your life in some important ways and you're bound to have some worries during this time. It may happen that a few friendly drinks will seem like a good way to stop whatever is troubling you. At those times, stop and try to think of other ways you might handle how you feel. It may help to talk to someone about what is bothering you. Or you may prefer to walk, listen to music or write out the things that you are feeling. You may be surprised at how effective some of these alternatives to alcohol can be. Social situations always seem to call for a drink.

LIVING WITH A HEART AILMENT - Original (REV 38)

Twenty-six years ago Warren H. had his first heart attack. It was massive with classic signs: a crushing pain in the chest, nausea, vomiting, shock, loss of consciousness. Later a doctor told him that the posterior wall of his heart had been badly damaged. Yet in two months, taking prescribed medications, Warren was up and about. After that frightening experience, he recalls, I fell into a deep depression and drank a lot. I felt life wasn't worth living anymore. But gradually I became reconciled and philosophical. I thought I'd die any minute, but so could anyone else - hit by a truck for instance.

The great majority of people weather their first attack. According to a study by Dr. Nanette Kass Wenger of the Emory University School of Medicine in Atlanta, "abou 80% of patients transferred from a Coronary Care Unit to general floor care are alive five years later and most are capable of active roles in their community. Exceptions are patients with diabetes particularly insulin-treated diabetic women. In long term follow-up study in Framingham, Massachusetts, they showed the greatest relative mortality for coronary heart disease. Still a doctor can help the patient keep diabetes in check by prescribing drugs, diet regimens, programs for weight control and exercise.

While medication and other measures do help most heart conditions, complex problems require special treatment. Dramatic advances have been scored in correcting congenital and acquired abnormalities of the heart and blood vessels. Surgery can now repair and replace damaged parts. In stenosis for instance, a valve becomes so narrowed that it does not function normally. When doctors find a major stenosis, an operation is often performed promptly. Coronary by-pass surgery, one of the latest developments, is a radical procedure in which a section of the patient's leg vein is grafted onto a diseased coronary artery to detour circulation around a blocked or severely diseased area.

LIVING WITH A HEART AILMENT - Revised (REV 38)

Twenty-six years ago Warren H. had his first heart attack. It was massive with classic signs: a crushing pain in the chest, throwing up, shock, passing out. Later a doctor told him that the back wall of his heart had been badly damaged. Yet in two months, taking drugs ordered by the doctor, Warren was up and about. After that frightening experience, he remembers, I felt very unhappy and drank a lot. I felt life wasn't worth living anymore. But gradually I became reconciled and philosophical. I thought I'd die any minute, but so could anyone else - hit by a truck for instance.

The great majority of people weather their first attack. According to a study by Dr. Nanette Kass Wenger of the Emory University School of Medicine in Atlanta, "about 80% of people transferred from a Coronary Care Unit to general floor care are alive five years later and most are capable of active roles in their neighbourhood. Exceptions are those with high blood sugar particularly diabetic women who are being treated. In long term follow-up study in Framingham, Massachusetts, they showed the greatest relative death rate for heart attack. Still a doctor can help a person keep diabetes in check by using drugs, planning healthy meals, programs to get thinner and using the body to make the heart beat faster.

While drugs and other measures do help most heart conditions, some kinds of heart troubles require treating in a special way. Dramatic discoveries have been scored in correcting troubles in the heart and blood vessels, both those a person is born with, and those that come later in life. Doctors can now repair and replace damaged parts. In stenosis for instance, the gate-like opening to a blood vessel becomes so narrowed that it does not work properly. When doctors find a major stenosis, cutting into the person is often performed promptly. Coronary by-pass surgery, one of the latest ways this is done, is a major repair in which a part of the blood vessel in a person's leg is fastened onto the damaged heart blood vessel, to detour blood flow around a blocked or severely narrowed part.

VARICOSE VEINS - Original (RCV45)

If you have varicose veins, you are only one of many people who have these enlarged and distorted veins. They are a common complaint in both men and women. Some people acquire varicose veins from injury or infections, but why they develop in others is not yet clearly understood. There is some indication however that a tendency to varicose veins may be inherited. Varicose veins primarily affect the legs and are frequently troublesome to people who are on their feet for long hours. Yet it is true that doctors see many cases among people whose work does not require standing.

Other factors can cause varicose veins, even in people who are born with normally healthy veins. When a vein is injured by disease or accident and phlebitis (inflammation of the vein) develops, the valves may be involved. If a blood clot or thrombus forms in the vein (thrombophlebitis), valves can be seriously damaged and made useless. Valves can also be affected when excessive overweight, tumours within the body or child-bearing interfere with the blood flow in deep veins. After pregnancy however, varicose veins often become less marked. Some elderly people are prone to them, because the veins tend to lose their elasticity with aging and the muscles supporting them weaken.

Surgeons usually operate on large varicose veins lying just under the skin. The enlarged veins may be removed by a process known as stripping in which a section of vein is tied off and surgically removed. Sometimes veins are tied off without complete removal in a process called ligation. Varicose veins recur more often when they are simply tied off or ligated, without stripping. When the surface veins are removed or tied off, the flow of blood is rerouted to the deep veins which carry the blood from the legs up to the heart.

VARICOSE VEINS - Revised (RCV45)

If you have varicose veins, you are only one of many people who have these enlarged and distorted veins. They are a common trouble in both men and women. Some people get varicose veins after being hurt, or having cuts that get red and hot, but why they develop in others is not yet clearly understood. There is some indication however that a tendency to varicose veins may be run in families. Varicose veins primarily affect the legs and are frequently troublesome to people who are on their feet for long hours. Yet it is true that doctors see many cases among people whose work does not require standing.

Other things can cause varicose veins, even in people who are born with - healthy veins. When a vein is harmed by sickness or accident and phlebitis (swelling of the vein) develops, the gate-like openings to the blood vessels may be involved. If blood (a thrombus) stops up the vein (thrombophlebitis), the openings can be seriously damaged and made useless. The openings can also be affected when excessive overweight, tumours (too many cells growing) within the body or child-bearing interfere with the blood flow in deep veins. After child-bearing however, varicose veins often become less marked. Some elderly people are prone to them, because the veins tend to lose their stretch with aging and the parts supporting them weaken.

Doctors usually repair large varicose veins lying just under the skin. The enlarged veins may be removed by what is called stripping in which a piece of vein is tied off and cut out. Sometimes veins are tied off without complete removal by what is called ligation. Varicose veins recur more often when they are simply tied off or ligated, without stripping. When the surface veins are removed or tied off, the flow of blood is rerouted to the deep veins which carry the blood from the legs up to the heart.

AIDS - Original (RCD72)

Since identification of the first case of AIDS - Acquired Immuno-Deficiency Syndrome - in North America in 1981, the public is becoming more aware of this disease. A poll tells us that 83% of Canadians have heard of AIDS. Unfortunately along with awareness of an illness of this nature, misconceptions often arise. This pamphlet is intended to give you the most accurate, up-to-date information available about AIDS. AIDS attacks the body's natural ability to fight disease. Patients become particularly vulnerable to unusual illnesses including rare, life threatening forms of cancer and pneumonia. Because of the weakened immune system, repeated attacks of these diseases often occur.

The way that AIDS is passed from one person to another is still being investigated. It seems most likely that semen and blood carry the agent. Several methods of transmission have been suggested: In homosexual men, anal intercourse appears to be the most likely method of spread. A man with AIDS may transmit the disease to his female sexual partner, but this has not occurred in Canada. A pregnant woman with AIDS could give the disease to her unborn child. A person with hemophilia may get AIDS through the blood products received for blood clotting problems.

Most people with these symptoms do not have AIDS. In fact many of us experience some of these types of problems from time to time. Do not be alarmed. However, if you or your sexual partners belong to one of the groups that may be at increased risk of AIDS, it is wise to see your doctor. As yet there is no treatment to restore the patient's ability to combat disease naturally. Doctors focus on treating those illnesses contracted because of the patient's weakened immune system. A cure for AIDS has not yet been found. Research into its cause continue world-wide.

AIDS - Revised (RCD72)

Since the first case of AIDS - Acquired Immuno-Deficiency Syndrome - was discovered in North America in 1981, the public is becoming more aware of this sickness. A poll tells us that 83% of Canadians have heard of AIDS. Unfortunately along with learning about a sickness of this nature, misconceptions often arise. This pamphlet is intended to give you the most accurate, up-to-date information available about AIDS. AIDS attacks the body's natural means to fight sickness. Those who are sick become particularly vulnerable to unusual troubles including rare, life threatening forms of cancer (too many cells growing) and pneumonia (too many bugs growing in the organs where you breathe). Because its harder for the body to stay healthy, repeated attacks of these sicknesses often occur.

The way that AIDS is passed from one person to another is still being investigated. It seems most likely that the man's seed and blood carry the agent. Several ways of passing the sickness have been suggested: In gay men, making love at the back passage appears to be the most likely means of spread. A man with AIDS may transmit the sickness to a woman who his sexual partner, but this has not occurred in Canada. A woman who is going to have a baby, and has AIDS could give the sickness to her unborn child. A person who is a bleeder may get AIDS through the blood - received to help stop bleeding.

Most people with these signs do not have AIDS. In fact many of us have some of these - troubles from time to time. Do not be alarmed. However, if you or your sexual partners belong to one of the groups that may be at higher risk of AIDS, it is wise to see your doctor. As yet there is no way to restore how a person combats the sickness naturally. Doctors focus on treating those other sicknesses which happen because the person can not fight them. A cure for AIDS has not yet been found. Research into its cause continue world-wide.

DIABETES: A MANUAL FOR CANADIANS - Original (RD102)

Diabetes was known to the physicians of India, Greece and other civilizations of ancient times. Chinese medical writings mentioned a condition of wasting with increased thirst and passing excessive quantities of urine. Aretaeus described the condition in about 70 AD giving it the name of diabetes, a Greek word for siphon or to run through. Paracelsus in the 16th century noticed the increased crystalline content of the urine after boiling but thought this was salt instead of sugar. Thomas Willis described the sweetness of urine some 100 years later and Dobson found this to be sugar thus establishing the name mellitus.

The first indications of this developing state of ketosis or ketoacidosis will be increasing glucose in the urine. This is why urine should be tested sufficiently frequently to give early warning of trouble during infection or stress. If glucose or acetone persists in large amounts for more than eight to twelve hours, the physician should be called since treatment with injected insulin may be needed to prevent diabetic ketoacidosis and coma. After recovery the diabetes may again be controlled by the simple measures which were effective before the episode.

For more information there is a pamphlet entitled "Pregnant and Diabetic" available from the Canadian Diabetes Association. The next question is "What about the children? Will they all develop diabetes if either or both parents have diabetes?" The answer is No. Current evidence suggests that if both parents have diabetes then approximately one out of every five of their children may develop diabetes at some time during its life, while if only one parent has diabetes, it will occur in one out of every ten of their children, although often not until later in adult life.

DIABETES: A MANUAL FOR CANADIANS - Revised (RD102)

Diabetes was known to the doctors of India, Greece and other civilizations of ancient times. Chinese writings about medicine mentioned a condition of wasting with greater thirst and passing excessive quantities of the person's water. Aretaeus described the condition in about 70 AD giving it the name of diabetes, a Greek word for siphon or to run through. Paracelsus in the 16th century noticed the higher sugar-like content of the water after boiling but thought this was salt instead of sugar. Thomas Willis described the sweetness of a person's water some 100 years later and Dobson found this to be sugar thus establishing the name mellitus.

The first signs of this developing state of ketosis or ketoacidosis will be higher glucose in the person's water. This is why the water should be tested sufficiently frequently to give early warning of trouble when not well or very worried. If glucose or acetone persists in large amounts for more than eight to twelve hours, the doctor should be called since he may need to treat with insulin by a needle to prevent diabetic ketoacidosis and coma. Later the diabetes may again be kept in check by the simple measures which were effective before the episode.

For more information there is a pamphlet entitled "Pregnant and Diabetic" available from the Canadian Diabetes Association. The next question is "What about the children? Will they all develop diabetes if either or both parents have diabetes?" The answer is No. Current evidence suggests that if both parents have diabetes then approximately one out of every five of their children may develop diabetes at some time during its life, while if only one parent has diabetes, it will occur in one out of every ten of their children, although often not until later in person's life.

CHRONIC COUGH - Original (RR154)

How many bottles of cough medicine did you buy last winter? Do you usually carry a package of cough drops? A cough may seem like such a common thing - you just dose it and ignore it. Don't do that. Your cough, if it is a chronic one, may be serious. Has your cough been hanging around for a month or more? Then you have a chronic cough. It doesn't matter that you cough only in the morning when you get up, or only at night when you lie down. If you've been coughing for more than a month, your cough is chronic.

Just about everybody coughs from time to time. The common cold for instance, is often followed by a cough that can last as long as two or three weeks. But if your cough following a cold hangs on longer than usual, it may be developing into a chronic cough. If there is shortness of breath with a cough, or any pain, or blood in what you cough up, you should see your doctor immediately, even though your cough may not have lasted more than a few days. Do you smoke a pack or more of cigarettes a day?

A chronic cough is not a disease in itself. It is a sign of something wrong with the breathing system. That's why it isn't smart to take a cough medicine for more than a week or two unless your doctor tells you to. Medicine may help with the cough, but meanwhile the underlying illness can be getting steadily worse. The most likely causes of chronic cough are lung cancer, bronchitis (inflammation in the lung tubes), bronchiectasis (in which pus pockets form along the tubes), tuberculosis, other lung diseases. The instant you realize you have a chronic cough, go to your doctor.

CHRONIC COUGH - Revised (RR154)

How many bottles of cough medicine did you buy last winter? Do you usually carry a package of cough drops? A cough may seem like such a common thing - you just treat it and ignore it. Don't do that. Your cough, if it is a chronic one, may be serious. Has your cough been hanging around for a month or more? Then you have a chronic cough. It doesn't matter that you cough only in the morning when you get up, or only at night when you lie down. If you've been coughing for more than a month, your cough is chronic.

Just about everybody coughs from time to time. The common cold for instance, is often followed by a cough that can last as long as two or three weeks. But if your cough following a cold hangs on longer than usual, it may be developing into a chronic cough. If there is shortness of breath with a cough, or any pain, or blood in what you cough up, you should see your doctor immediately, even though your cough may not have lasted more than a few days. Do you smoke a pack or more of cigarettes a day?

A chronic cough is not a sickness in itself. It is a sign of something wrong with the organ where you breathe. That's why it isn't smart to take a cough medicine for more than a week or two unless your doctor tells you to. Medicine may help with the cough, but meanwhile the underlying reason can be getting steadily worse. The most likely causes of chronic cough are too many cells growing inside the chest (lung cancer) or bugs hurting you where you breathe (bronchitis, bronchiectasis, tuberculosis). The instant you realize you have a chronic cough, go to your doctor.

APPENDIX C

LIST OF ALL DIFFICULT TECHNICAL TERMINOLOGY (N=532)
IDENTIFIED IN "PREVENTATIVE" AND "RESTORATIVE"
PASSAGES AND FREQUENCY OF OCCURRENCE
OF EACH WORD

1	ABDOMEN	1	ABDOMINAL	4	ABILITY
3	ABNORMAL	8	ABNORMALITY	1	ABNORMALLY
2	ABSTINENCE	4	ABUSE	1	ACETONE
2	ACID	3	ACQUIRED	1	ADAPTATION
1	ADJUSTMENT	5	ADULT	1	ADVANCE
2	AEROBIC	19	ALOCHOL	3	ALOCHOLIC
1	ALLERGEN	4	ALLERGIC	6	ALLERGY
6	ALZHEIMERS	2	ANAEMIA	2	ANAL
3	ANKLE	1	ANTIDOTE	1	ANTIHISTAMINE
1	ANTISEPTIC	8	ANXIETY	1	AORTA
1	APPARATUS	1	APPARENT	1	APPLICATOR
1	ARCH	7	AREA	1	AREOLA
1	ARTERIAL	6	ARTERY	4	ARTIFICIAL
1	ASBESTOS	4	ASSOCIATED	1	ATTITUDE
1	ATHEROSCLEROSIS	1	AWARENESS	1	BACKACHE
3	BALANCE	2	BARRIER	1	BASAL
2	BEHAVIOUR	1	BEHAVIOURAL	1	BIOLOGICAL
3	BIOPSY	1	BOWEL	1	BREAKDOWN
1	BRONCHIECTASIS	2	BRONCHITIS	2	CAFFEINE
1	CALLUS	9	CALORIE	30	CANCER
1	CANCEROUS	7	CANNABIS	1	CAPACITY
1	CARBOHYDRATE	3	CARBON	1	CARCINOGEN
3	CARDIOVASCULAR	3	CERVIX	1	CHAMBERED
1	CHARACTERISTIC	2	CHEMICAL	1	CHEMOTHERAPY
3	CHOLESTEROL	11	CHRONIC	1	CIRCULATING
4	CIRCULATION	2	CIRCULATORY	1	CLINICAL
1	CLOT	2	CLOTTING	1	COMA
2	COMBINATION	7	COMMUNITY	2	COMPLAINT
2	COMPLEX	1	COMPLICATED	1	COMPONENT
1	COMPULSIVELY	1	CONCEIVED	1	CONCEPTION
1	CONDENSE	1	CONDITIONED	5	CONDOM
1	CONFLICT	1	CONFUSION	2	CONGENITAL
2	CONGESTION	2	CONGESTIVE	1	CONSCIOUSNESS
1	CONSTIPATED	1	CONSTRICTION	1	CONSULTANT
1	CONSUMPTION	1	CONTAGIOUS	2	CONTRACEPTION

4	CONTRACEPTIVE	1	CONTRAINDICATIONS	2	CONTRACT
16	CONTROL	4	COORDINATION	1	COPE
10	CORONARY	1	CRYO	1	CRYSTALLINE
1	CULTURE	1	CUMULATIVE	7	CYCLE
1	DEAFNESS	1	DECAY	5	DECREASE
8	DEFECT	1	DEFICIENCY	1	DEFORMITY
1	DEGENERATION	1	DELIVER	10	DEMENTIA
1	DEPRESSION	1	DESICATION	2	DETERIORATION
3	DEVELOPMENT	1	DEVICE	14	DIABETES
11	DIABETIC	3	DIAGNOSE	12	DIAGNOSIS
5	DIAPHRAGM	1	DIARRHEA	1	DIASTOLE
17	DIET	1	DIFFERENCE	1	DIOXIDE
1	DISCHARGE	26	DISEASE	3	DISORDER
1	DIZZINESS	1	DONOR	1	DOSAGE
8	DOSE	2	DROWSINESS	1	DYNAMIC
2	EDEMA	11	EFFECT	1	EFFICIENCY
3	EFFORT	1	EJACULATION	1	ELASTICITY
1	ELECTRO	5	EMOTIONAL	1	EMOTIONALLY
13	EMPHYSEMA	6	ENERGY	1	ENGORGEMENT
3	ENVIRONMENT	1	ERECTION	5	ESSENTIAL
1	EVENT	7	EXAMINATION	1	EXCITEMENT
14	EXERCISE	6	EXPERIENCE	1	EXPOSED
1	EXPRESS	1	EXTEND	1	EXTENSION
1	FACIAL	6	FACTOR	5	FAILURE
1	FALLOPIAN	1	FALLOT	2	FATIGUE
6	FATTY	2	FEEDINGS	12	FEELINGS
2	FEMALE	3	FERTILE	2	FERTILITY
1	FERTILIZING	1	FETAL	2	FETUS
2	FILTER	9	FITNESS	3	FLUID
2	FOCUS	1	FOREARM	1	FOREFINGER
1	FOUNDATION	1	FREQUENCY	1	FRICTION
3	FUNCTION	1	GASEOUS	1	GENERATION
1	GENETIC	3	GLUCOSE	1	GM
1	GRAFTED	2	GRASP	1	GRASPING
1	GRAVITY	2	GROWTH	1	GYNECOLOGIST
1	HASHISH	1	HEMOPHILIA	1	HEREDITARY
1	HOMOSEXUAL	1	HUMIDITY	1	HYGIENE
2	HYPERTENSION	1	IDENTIFICATION	13	ILLNESS
2	IMMUNE	1	IMMUNO	4	IMPAIRMENT
1	INCIDENCE	1	INCOMPATIBILITY	21	INCREASE
2	INCREASING	2	INDICATION	2	INDIGESTION
6	INFANT	3	INFARCT	1	INFARCTION
2	INFECTED	10	INFECTION	1	INFERTILE
2	INFESTATION	2	INFLAMMATION	1	INFLATION
3	INHERITED	2	INJECTED	1	INJURED
6	INJURY	4	INSEMINATION	2	INSERTION
1	INSTRUMENT	9	INSULIN	2	INTENSITY
4	INTERCOURSE	1	INTERVENTION	2	INTOXICATION
1	INVALID	1	IRREGULARITIES	2	IODINE
2	IRRITATION	1	ISSUE	1	ITCHING
10	IUD	3	JOINT	2	KETOACIDOSIS
1	KETOSIS	1	LABORATORY	1	LANOLIN

1	LIGATED	1	LIGATION	4	LIMIT
1	LINOLEIC	1	LITRE	1	LOTION
2	LOUSE	10	LUNG	1	MADNESS
1	MALFUNCTION	2	MALIGNANT	1	MAMMOGRAPHY
1	MARIJUANA	1	MASTECTOMY	1	MATERIAL
1	MECHANICAL	15	MEDICAL	5	MEDICATION
4	MELANOMA	1	MELLITUS	2	MEMORY
1	MENOPAUSE	1	MENSTRUAL	12	MENTAL
5	MENTALLY	1	MERCURY	15	METHOD
1	MICROSCOPE	1	MINOR	1	MISCARRIAGE
1	ML	1	MM	1	MODIFICATION
5	MOLD	1	MONITOR	2	MONOXIDE
2	MOOD	1	MORTALITY	1	MOTION
1	MOTIVATION	1	MOTIVE	2	MOVEMENT
2	MULTI	1	MULTIPLE	8	MUSCLE
2	MUSCULAR	1	MYOCARDIAL	2	NAUSEA
1	NEUROLOGICAL	1	NICOTINE	4	NIPPLE
4	NIT	10	NORMAL	2	NORMALLY
2	NUTRIENT	1	NUTRITION	1	NUTRITIONAL
1	OBESITY	1	OBSTRUCTION	2	OPERATE
3	OPERATION	1	OPTIMUM	2	OUTPUT
1	OVARY	2	OVULATION	3	OXYGEN
1	PANIC	1	PARTICLE	16	PATIENT
1	PELVIC	1	PENETRATION	5	PENIS
4	PER	1	PEDIATRICIAN	6	PERIOD
1	PERIODIC	1	PERNICIOUS	1	PERSISTENCE
1	PETROLATUM	1	PHARMACIST	2	PHASE
1	PHLEBITIS	18	PHYSICAL	1	PHYSICALLY
16	PHYSICIAN	1	PHYSIOLOGICAL	1	PNEUMONIA
5	POLLUTION	1	POLYUNSATURATED	1	POPULATION
1	POSITION	1	POSTERIOR	1	POSTNATAL
3	POSTURE	1	POTENTIALLY	1	PRE
1	PRECANCEROUS	8	PREGNANCY	6	PREGNANT
2	PREMATURE	1	PRENATAL	2	PRESBYCUSIS
6	PRESCRIBE	1	PRESCRIBING	4	PRESCRIPTION
14	PRESSURE	1	PREVENTION	1	PRIMARY
36	PROBLEM	4	PROCEDURE	9	PROCESS
1	PROCESSING	6	PRODUCT	3	PROFESSIONAL
1	PROGNOSIS	2	PROGRESSIVE	2	PROTECTION
2	PSYCHIATRIC	2	PSYCHOLOGICAL	1	PSYCHOTIC
3	PULMONARY	2	PUS	1	RADIATION
2	RADICAL	4	REACTION	1	REALITY
3	RECOVERY	5	REDUCE	3	REDUCING
1	REGIMEN	1	REGION	2	REGULARITY
1	REINFESTATION	2	RELATIONSHIP	9	RELAX
1	RELAXATION	1	RELAXES	2	RELAXING
2	RELIEF	4	RELIEVE	1	REMEDY
1	REPRODUCTIVE	1	RESPIRATORY	3	RESPONSE
1	REVITALIZING	2	RHYTHM	1	ROLE
3	SATURATED	1	SCALP	1	SCAN
5	SCHEDULE	1	SCHIZOPHRENIA	2	SECTION
1	SEIZURE	1	SEMEN	2	SENILE

1	SENILITY	1	SEPTAL	2	SERIES
2	SEX	2	SHAFT	1	SHIFTING
1	SIGNIFICANT	1	SIPHON	1	SITE
1	SITUATIONAL	1	SODIUM	2	SOLID
4	SPECIALIST	3	SPECIFIC	5	SPHERM
1	SPERMATOZOA	1	SPERMICIDAL	2	SPHINCTER
1	SPHYGMOMANOMETER	1	SPINAL	1	SPORE
1	SQUAMOUS	1	STAIN	1	STATISTIC
3	STENOSIS	2	STERILE	5	STERILITY
1	STILLBIRTH	2	STIMULATE	1	STRAIN
11	STRESS	2	STROKE	5	SUBSTANCE
1	SUBSTITUTE	14	SUICIDE	2	SURGEON
7	SURGERY	1	SURGICAL	1	SURGICALLY
1	SURVEILLANCE	1	SWOLLEN	11	SYMPTOM
3	SYNDROME	2	SYNTHETIC	7	SYSTEM
1	SYSTOLE	1	TARGET	2	TECHNIQUE
5	TEMPERATURE	1	TENSE	11	TENSION
1	TETRALOGY	1	THERMAL	1	THERMOGRAPHY
1	THIRST	1	THROMBOPHLEBITIS	1	THROMBUS
1	THYROID	6	TISSUE	5	TOENAIL
1	TOLERANCE	2	TRANQUILLIZER	1	TRAIT
1	TRANSMISSION	13	TREATMENT	3	TUBE
1	TUBERCULOSIS	2	TUMOUR	1	TWEEZER
12	TYPE	1	UNBORN	1	UNCONSCIOUS
1	UNHEALTHY	3	UNIT	2	UNOXYGENATED
1	UNTREATED	2	URETHRAL	1	URINATE
1	URINATION	5	URINE	3	UTERUS
5	VAGINA	2	VAGINAL	5	VALVE
8	VARICOSE	1	VASCULAR	23	VEIN
5	VENTRICLE	1	VENTRICULAR	1	VERGE
3	VESSEL	1	VITALITY	1	VOLUNTARY
2	VOMITING	8	WEIGHT	1	WITHDRAWAL
1	XEROGRAPHY				

APPENDIX D

LETTER AND INSTRUCTION SHEET GIVEN TO EACH NURSE JUDGE

8315 - 120 St.,
Edmonton, Alberta,
T6G 1X1,
May 7, 1985

Dear

Thank you for agreeing to act as a content expert for my thesis. I am enclosing a summary of the research. I am also enclosing an original and revised version of each of the 50 passages, and an instruction sheet for your guidance in making your assessments. While the revisions are intended to produce pamphlets which are educational but have language and concepts which are known to the average reader, it is important that the revised versions also retain the meaning of the original passage. Please judge the similarity of meaning of the revised to the original words, based on your nursing knowledge of health-related terminology, and on your perception of the language used by the average person for the same terminology.

If you are interested in the criteria I have used in making the word replacement, or in seeing the list of Dale-Chall list of 3000 familiar words, I have included these at the back of the folder.

Please do not hesitate to phone me if you have any questions or problems (439-0876). I would be grateful if I could have your assessments back by Monday, May 13th. Thank you very much for your help with this analysis.

Yours sincerely,

Jane Hopkinson

INSTRUCTION SHEET

1) Underlined words - in the original passages are words that will be changed.
   - in the revised passages are the replacement words.

2) Each underlined word(s) in the original passages is matched with its replacement word(s) in the revised version, by a number in the margin of the passage, and the same number in column #1 of the scoring grid.

3) If one group of words continues onto a second line, the I.D. number is at the line containing the first word in the group.

4) Each group of words is underlined by a continuous line. A break in underlining identifies the next word(s) for replacement.

5) If a word in the original passages has been deleted, and no replacement used, an underline represents the deleted word, and is identified by number in the margin.

6) For each passage:

   - read the original and revised versions of the passages.
   - compare the underlined word(s) in the original version with the corresponding underlined word(s) in the revised version.
   - decide for each comparison, whether the replacement word(s):

     i) conveys the original meaning.
     ii) fails to convey the original meaning OR removal without replacement fails to convey the same meaning.
     iii) unable to decide.

7) Each passage is followed by a scoring grid. Place a tick in the appropriate column of the scoring grid. Choose one option only for each word(s).

8) If, for any word which has been changed, you can suggest a replacement word(s) which could convey the intended meaning more accurately, please use the last column to make your suggestions. (Some words have been particularly troublesome, eg. 'coordination', 'balance', 'constipated', 'contraception', and the replacements are clumsy.)

9) If you wish to make any comments, please write them on the revision pages.